

# Harness Making



# HANDICRAFT SERIES.

A Series of Practical Manuals.

Edited by PAUL N. HASLUCK, Editor of "Work."

*Price 50cts. each, post paid.*

**House Decoration.** Comprising WHITEWASHING, PAPERHANGING, PAINTING, etc. With 79 Engravings and Diagrams.

*Contents.*—Colour and Paints. Pigments, Oils, Driers, Varnishes, etc. Tools used by Painters. How to Mix Oil Paints. Distemper or Tempera Painting. Whitewashing and Decorating a Ceiling. Painting a Room. Papering a Room. Embellishment of Walls and Ceilings.

**Boot Making and Mending.** Including REPAIRING, LASTING, and FINISHING. With 179 Engravings and Diagrams.

*Contents.*—Repairing Heels and Half-Soling. Patching Boots and Shoes. Re-Welting and Re-Soling. Boot Making. Lasting the Upper. Sewing and Stitching. Making the Heel. Knifing and Finishing. Making Riveted Boots and Shoes.

**How to Write Signs, Tickets, and Posters.** With 170 Engravings and Diagrams.

*Contents.*—The Formation of Letters, Stops, and Numerals. The Sign-writer's Outfit. Making Signboards and Laying Ground Colours. The Simpler Forms of Lettering. Shaded and Fancy Lettering. Painting a Signboard. Ticket-Writing. Poster-Painting. Lettering with Gold, etc.

**Wood Finishing.** Comprising STAINING, VARNISHING, and POLISHING. With Engravings and Diagrams.

*Contents.*—Processes of Finishing Wood. Processes of Staining Wood. French Polishing. Fillers for Wood and Filling In. Bodying In and Spiriting Off. Glazing and Wax Finishing. Oil Polishing and Dry Shining. Re-polishing and Reviving. Hard Stopping or Beaumontage. Treatment of Floors Stains. Processes of Varnishing Wood Varnishes. Re-polishing Shop Fronts.

**Dynamos and Electric Motors.** With 142 Engravings and Diagrams

*Contents.*—Introduction. Siemens Dynamo. Gramme Dynamo. Manchester Dynamo. Simplex Dynamo. Calculating the Size and Amount of Wire for Small Dynamos. Ailments of Small Dynamo Electric Machines: their Causes and Cures. Small Electro-motors without Castings. How to Determine the Direction of Rotation of a Motor. How to Make a Shuttle-Armature Motor. Undertype 50-Watt Dynamo. Manchester Type 440-Watt Dynamo.

**Cycle Building and Repairing.** With 142 Engravings and Diagrams.

*Contents.*—Introductory, and Tools Used. How to Build a Front Driver. Building a Rear-driving Safety. Building Tandem Safeties. Building Front-driver Tricycle. Building a Hand Tricycle. Brazing. How to Make and Fit Gear Cases. Fittings and Accessories. Wheel Making. Tyres and Methods of Fixing them. Enamelling. Repairing.

**Decorative Designs of All Ages for All Purposes.** With 277 Engravings and Diagrams.

*Contents.*—Savage Ornament. Egyptian Ornament. Assyrian Ornament. Greek Ornament. Roman Ornament. Early Christian Ornament. Arabic Ornament. Celtic and Scandinavian Ornaments. Mediæval Ornament. Renaissance and Modern Ornaments. Chinese Ornament. Persian Ornament. Indian Ornament. Japanese Ornament.

**Mounting and Framing Pictures.** With 240 Engravings, etc.

*Contents.*—Making Picture Frames. Notes on Art Frames. Picture Frame Cramps. Making Oxford Frames. Gilding Picture Frames. Methods of Mounting Pictures. Making Photograph Frames. Frames covered with Plush and Cork. Hanging and Packing Pictures.

**Smiths' Work.** With 211 Engravings and Diagrams.

*Contents.*—Forges and Appliances. Hand Tools. Drawing Down and Up-setting. Welding and Punching. Conditions of Work: Principles of Formation. Bending and Ring Making. Miscellaneous Examples of Forged Work. Cranks, Model Work, and Die Forging. Home-made Forges. The Manipulation of Steel at the Forge.

(Continued on next page.)

DAVID McKAY, Publisher, 1022 Market Street, Philadelphia.

## **HANDICRAFT SERIES** (*continued*).

**Glass Working by Heat and Abrasion.** With 300 Engravings and Diagrams.

*Contents.*—Appliances used in Glass Blowing. Manipulating Glass Tubing. Blowing Bulbs and Flasks. Jointing Tubes to Bulbs forming Thistle Funnel, etc. Blowing and Etching Glass Fancy Articles; Embossing and Gilding Flat Surfaces. Utilising Broken Glass Apparatus; Boring Holes in, and Riveting Glass. Hand-working of Telescope Specula. Turning, Chipping, and Grinding Glass. The Manufacture of Glass.

**Building Model Boats.** With 168 Engravings and Diagrams.

*Contents.*—Building Model Yachts. Rigging and Sailing Model Yachts. Making and Fitting Simple Model Boats. Building a Model Atlantic Liner. Vertical Engine for a Model Launch. Model Launch Engine with Reversing Gear. Making a Show Case for a Model Boat.

**Electric Bells, How to Make and Fit Them.** With 162 Engravings and Diagrams.

*Contents.*—The Electric Current and the Laws that Govern it. Current Conductors used in Electric-Bell Work. Wiring for Electric Bells. Elaborated Systems of Wiring; Burglar Alarms. Batteries for Electric Bells. The Construction of Electric Bells, Pushes, and Switches. Indicators for Electric-Bell Systems.

**Bamboo Work.** With 177 Engravings and Diagrams.

*Contents.*—Bamboo: Its Sources and Uses. How to Work Bamboo. Bamboo Tables. Bamboo Chairs and Seats. Bamboo Bedroom Furniture. Bamboo Hall Racks and Stands. Bamboo Music Racks. Bamboo Cabinets and Bookcases. Bamboo Window Blinds. Miscellaneous Articles of Bamboo. Bamboo Mail Cart.

**Taxidermy.** With 108 Engravings and Diagrams.

*Contents.*—Skinning Birds. Stuffing and Mounting Birds. Skinning and Stuffing Mammals. Mounting Animals' Horned Heads: Polishing and Mounting Horns. Skinning, Stuffing, and Casting Fish. Preserving, Cleaning, and Dyeing Skins. Preserving Insects, and Birds' Eggs. Cases for Mounting Specimens.

**Tailoring.** With 180 Engravings and Diagrams.

*Contents.*—Tailors' Requisites and Methods of Stitching. Simple Repairs and Pressing. Relining, Repocketing, and Recollaring. How to Cut and Make Trousers. How to Cut and Make Vests. Cutting and Making Lounge and Reefer Jackets. Cutting and Making Morning and Frock Coats.

**Photographic Cameras and Accessories.** Comprising How to MAKE CAMERAS, DARK SLIDES, SHUTTERS, and STANDS. With 160 Illustrations.

*Contents.*—Photographic Lenses and How to Test them. Modern Half-plate Cameras. Hand and Pocket Cameras. Ferrotypes Cameras. Stereoscopic Cameras. Enlarging Cameras. Dark Slides. Cinematograph Management.

**Optical Lanterns.** Comprising THE CONSTRUCTION AND MANAGEMENT OF OPTICAL LANTERNS AND THE MAKING OF SLIDES. With 160 Illustrations.

*Contents.*—Single Lanterns. Dissolving View Lanterns. Illuminant for Optical Lanterns. Optical Lantern Accessories. Conducting a Limelight Lantern Exhibition. Experiments with Optical Lanterns. Painting Lantern Slides. Photographic Lantern Slides. Mechanical Lantern Slides. Cinematograph Management.

**Engraving Metals.** With Numerous Illustrations.

*Contents.*—Introduction and Terms used. Engravers' Tools and their Uses. Elementary Exercises in Engraving. Engraving Plate and Precious Metals. Engraving Monograms. Transfer Processes of Engraving Metals. Engraving Name Plates. Engraving Coffin Plates. Engraving Steel Plates. Chasing and Embossing Metals. Etching Metals.

**Basket Work.** With 189 Illustrations.

*Contents.*—Tools and Materials. Simple Baskets. Grocer's Square Baskets. Round Baskets. Oval Baskets. Flat Fruit Baskets. Wicker Elbow Chairs. Basket Bottle-casings. Doctors' and Chemists' Baskets. Fancy Basket Work. Sussex Trug Basket. Miscellaneous Basket Work. Index

DAVID MCKAY, Publisher, 1022 Market Street, Philadelphia.

## **HANDICRAFT SERIES** *(continued).*

### **Bookbinding.** With 125 Engravings and Diagrams.

*Contents.*—Bookbinders' Appliances. Folding Printed Book Sheets. Beating and Sewing. Rounding, Backing, and Cover Cutting. Cutting Book Edges. Covering Books. Cloth-bound Books, Pamphlets, etc. Account Books, Ledgers, etc. Coloring, Sprinkling, and Marbling Book Edges. Marbling Book Papers. Gilding Book Edges. Sprinkling and Tree Marbling Book Covers. Lettering, Gilding, and Finishing Book Covers. Index.

### **Bent Iron Work.** Including ELEMENTARY ART METAL WORK. With 269 Engravings and Diagrams.

*Contents.*—Tools and Materials. Bending and Working Strip Iron. Simple Exercises in Bent Iron. Floral Ornaments for Bent Iron Work. Candlesticks. Hall Lanterns. Screens, Grilles, etc. Table Lamps. Suspended Lamps and Flower Bowls. Photograph Frames. Newspaper Rack. Floor Lamps. Miscellaneous Examples. Index.

### **Photography.** With 70 Engravings and Diagrams.

*Contents.*—The Camera and its Accessories. The Studio and Darkroom. Plates. Exposure. Developing and Fixing Negatives. Intensification and Reduction of Negatives. Portraiture and Picture Composition. Flashlight Photography. Retouching Negatives. Processes of Printing from Negatives. Mounting and Finishing Prints. Copying and Enlarging. Stereoscopic Photography. Ferrottype Photography. Index.

### **Upholstery.** With 162 Engravings and Diagrams.

*Contents.*—Upholsterers' Materials. Upholsterers' Tools and Appliances. Webbing, Springing, Stuffing, and Tufting. Making Seat Cushions and Squabs. Upholstering an Easy Chair. Upholstering Couches and Sofas. Upholstering Footstools, Fenderettes, etc. Miscellaneous Upholstery. Mattress Making and Repairing. Fancy Upholstery. Renovating and Repairing Upholstered Furniture. Planning and Laying Carpets and Linoleum. Index.

### **Leather Working.** With 152 Engravings and Diagrams.

*Contents.*—Qualities and Varieties of Leather. Strap Cutting and Making. Letter Cases and Writing Pads. Hair Brush and Collar Cases. Hat Cases. Banjo and Mandoline Cases. Bags. Portmanteaux and Travelling Trunks. Knapsacks and Satchels. Leather Ornamentation. Footballs. Dyeing Leather. Miscellaneous Examples of Leather Work. Index.

### **Harness Making.** With 197 Engravings and Diagrams.

*Contents.*—Harness Makers' Tools. Harness Makers' Materials. Simple Exercises in Stitching. Looping. Cart Harness. Cart Collars. Cart Saddles. Fore Gear and Leader Harness. Plough Harness. Bits, Spurs, Stirrups, and Harness Furniture. Van and Cab Harness. Index.

### **Saddlery.** With 99 Engravings and Diagrams.

*Contents.*—Gentleman's Riding Saddle. Panel for Gentleman's Saddle. Ladies' Side Saddles. Children's Saddles or Pilches. Saddle Cruppers, Breastplates, and other Accessories. Riding Bridles. Breaking-down Tackle. Head Collars. Horse Clothing. Knee-caps and Miscellaneous Articles. Repairing Harness and Saddlery. Re-lining Collars and Saddles. Riding and Driving Whips. Superior Set of Gig Harness. Index.

### **Other Volumes in Preparation.**

WORK" HANDBOOKS

# HARNESS MAKING



# HARNES MAKING

*WITH NUMEROUS ENGRAVINGS AND DIAGRAMS*

EDITED BY

PAUL N. HASLUCK

EDITOR OF "WORK" AND "BUILDING WORLD,"  
AUTHOR OF "HANDYBOOKS FOR HANDICRAFTS," ETC. ETC.

PHILADELPHIA

DAVID McKAY, PUBLISHER

1022 MARKET STREET

1904

TS1032

.H35

64677  
05

64677  
05

REV. Feb. 11, 1905.

## PREFACE.

---

THIS Handbook contains, in form convenient for everyday use, a comprehensive digest of the knowledge of harness making, scattered over more than twenty thousand columns of *WORK*—one of the weekly journals it is my fortune to edit—and supplies concise information on the details of the subjects of which it treats.

In preparing for publication in book form the mass of relevant matter contained in the volumes of *WORK*, much had to be arranged anew. However, it may be stated that the greater part of the contents of this Handbook consists substantially of matter contributed by a working harness maker.

Readers who may desire additional information respecting special details of the matters dealt with in this Handbook, or instructions on kindred subjects, should address a question to *WORK*, so that it may be answered in the columns of that journal.

P. N. HASLUCK.

*La Belle Sauvage, London,*  
May, 1904.

# CONTENTS.

CHAPTER	PAGE
I.—Harness-makers' Tools . . . . .	9
II.—Harness-makers' Materials . . . . .	30
III.—Strap Making and Stitching . . . . .	49
IV.—Looping . . . . .	57
V.—Cart Harness . . . . .	62
VI.—Cart Collars . . . . .	75
VII.—Cart Saddles, Reins, etc. . . . .	86
VIII.—Fore Gear and Leader Harness . . . . .	101
IX.—Plough Harness . . . . .	107
X.—Bits, Spurs, Stirrups, and Harness Furniture	111
XI.—Van and Cab Harness . . . . .	127
Index . . . . .	157

# LIST OF ILLUSTRATIONS.

FIG.	PAGE	FIG.	PAGE
1.—Paring Knife . . .	10	54.—Home - made Clamp Holding Work . . .	25
2.—Hand Knife . . .	10	55.—Jaws of Clamp . . .	25
3.—Round Knife . . .	11	56.—Nail-claw . . .	26
4.—Head Knife . . .	11	57.—Cutting Pliers . . .	26
5.—Cutting Gauge . . .	11	58.—Iron Collar Rod . . .	27
6.—Plough or Plough Gauge	12	59.—Steel Seat-iron . . .	27
7.—Side Elevation of Plough Gauge . . .	12	60.—Loop-stick . . .	28
8.—End Elevation of Plough Gauge . . .	13	61.—Rubber . . .	28
9.—Slitting Machine . . .	13	62.—Straining Fork . . .	29
10.—Spokeshave . . .	13	63.—Cutting up Hide . . .	39
11.—Edge Trimmer . . .	14	64.—Plain Waist Belt . . .	53
12.—Washer Cutter . . .	14	65.—Fancy Waist Belt . . .	54
13.—Round Punch . . .	15	66.—Waist Belt with Pockets . . .	55
14.—Oval Punch . . .	15	67.—Box Creased Loop . . .	53
15.—Buckle Tongue, or Crew, Punch . . .	15	68.—Box Creased Loop . . .	59
16.—Girth Chape Punch . . .	15	69, 70.—Box Creased Loops	60
17.—Brace End Punch . . .	15	71.—Horse in Cart Gear . . .	62
18.—Forepart of Brace End Punch . . .	16	72 to 75.—Scotch Brass Gear Buckles . . .	63
19.—Hand Punch . . .	16	76, 77.—Brass Face-pieces . . .	64
20.—Hand Punch Nipple . . .	16	78.—Brass Face-piece . . .	65
21 to 24.—Scalloping Irons . . .	16	79.—Bells and Brush . . .	65
25, 26.—Rosette Punches . . .	17	80, 81.—Brass Hame Plates . . .	65
27.—Lead Piece . . .	17	82.—Brass Oval . . .	66
28.—Wooden Mallet . . .	17	82 to 85.—Brass Octagons . . .	66
29, 30.—Useful Wooden Mallets . . .	17	86.—Brass Heart . . .	66
31.—Saddlers' Hammer . . .	18	87, 88.—Brass Stars . . .	66
32.—Pricking-iron . . .	18	89, 90.—Brass Hame Knobs . . .	67
33, 34.—Wheel Prickers . . .	18	91, 92.—Brass Swing . . .	67
35.—Screw-race . . .	19	93.—Ear-piece . . .	67
36.—Single Crease . . .	19	94.—Corner-piece . . .	67
37.—Screw-crease . . .	19	95.—Cart Collar without Side-piece . . .	75
38.—Checker . . .	20	96.—Cart Collar Lining . . .	79
39.—Beveller . . .	20	97.—Cart Collar Side-piece . . .	83
40.—Compasses . . .	20	98.—Cart Saddle Tree . . .	87
41.—Race Compasses . . .	20	99.—Cart Saddle Panel . . .	89
42, 43.—Awl Blades . . .	21	100.—Cart Saddle Hind Housing . . .	93
44.—Sewing Awl . . .	22	101.—Cart Saddle Front Housing . . .	95
45.—Bent Awl . . .	22	102.—Set of Leader Gear . . .	103
46, 47.—Harness Needles . . .	23	103, 104.—Hip-strap Chains . . .	105
48, 49.—Seat Awls . . .	23	105.—Plough Back-band Hook . . .	109
50, 51.—Hand-irons or Palm-irons . . .	24	106 to 108.—Pelham Bits . . .	111
52.—Clamp or Clams . . .	24	109.—Hackney Bit . . .	111
53.—Clamp for Sewing Shaft-tugs . . .	25	110.—Bridoon . . .	111

FIG.	PAGE
111, 112.—Ladies' Horse Bits.	112
113.—Pelham Snaffle with Indiarubber Mouth .	112
114.—Hackney Bit with Indiarubber Mouth .	112
115.—Gig Snaffle . . .	113
116.—Wilson Snaffle . . .	113
117.—Liverpool Bit . . .	113
118.—Globe Check Curb Bit .	113
119.—One-horn Bridoon Bit .	113
120.—One-horned Bridoon with Indiarubber Mouth . . .	114
121.—Gig Curb Bit . . .	114
122.—Buxton Bit . . .	114
123.—Swivelled Bridoon Bit .	114
124, 125.—Breaking Bits . .	114
126.—Breaking Bit . . .	115
127.—Snaffle with India- rubber Mouth . . .	115
128, 129.—Exercising Bits .	115
130.—Show or Stallion Bit .	115
131.—Double-mouthed Snaffle	116
132.—Ordinary Spur . . .	116
133.—Officer's Regulation Spur . . .	116
134.—Dress Spur . . .	116
135.—Lady's Spur . . .	117
136.—Trousers Spur . . .	117
137.—Solid Stirrup . . .	117
138.—Open Button Stirrup .	117
139.—Waving Bar Stirrup .	117
140.—Lady's Stirrup . . .	117
141.—Stirrup Slipper . . .	118
142.—Safety Stirrup . . .	118
143.—Flat Side Wire Front Buckle . . .	118
144.—Front Bevelled Buckle	118
145.—Bevelled Flat Top Buckle . . .	118
146.—West End Bevelled Flat Top Buckle . . .	118
147.—Spade Buckle . . .	118
148.—Square Wire Buckle .	119
149.—Chatham Buckle . . .	119

FIG.	PAGE
150.—Flat Top Turned-up Buckle . . .	119
151.—Fluted Buckle . . .	119
152.—Swelled Front Bent-leg Buckle . . .	119
153.—Flat Top Cab Buckle .	119
154.—West End Whole Buckle . . .	119
155.—Chased Buckle . . .	120
156.—Melbourne Buckle . .	120
157.—Square Buckle . . .	120
158, 159.—Covered Buckles .	120
160, 161.—Part - covered Buckles . . .	120
162.—Shaft Tug Buckle . .	121
163.—Burgess's Buckle . .	121
164.—Ball Terret . . .	121
165.—Plain Terret . . .	121
166 to 168.—Ball Terrets . .	122
169 to 172.—Hames . . .	123
173, 174.—Bearing-rein Swi- vels . . .	123
175, 176.—Roller Buckles .	124
177.—Hame Clip . . .	125
178, 179.—Breeching Dees .	125
180, 181.—Winkers . . .	129
182.—Van Saddle . . .	131
183.—Van Saddle Flap . .	131
184.—Van Saddle Panel . .	131
185.—Chain and Leather Gig Front . . .	140
186.—Chain and Leather Gig Front . . .	141
187.—Chain and Leather Gig Front . . .	143
188.—Crupper Dock . . .	147
189.—Breeching, etc. . .	147
190.—Back-band . . .	147
191.—Shaft Tugs . . .	147
192.—Four-wheeled Cab Sad- dle . . .	153
193.—Cab Saddle Tree . .	153
194.—Hansom Cab Saddle .	154
195, 196.—Rein Stops . . .	154
197.—Hansom Cab Harness .	155

# HARNESS MAKING.

---

## CHAPTER I.

### HARNESS-MAKERS' TOOLS.

HARNESS making and repairing is a branch of leather work that can often be undertaken profitably by many persons, and the information given in the following pages has been adapted specially to the amateur's requirements. Doubtless the readers of a companion handbook on "Boot Making and Mending" have wished to pursue further the subject of leather working, and will take up the making and repairing of harness with pleasure. Aspirants to more highly skilled work will find "Practical Saddlery" of the greatest possible use to them, whilst readers less ambitious may look to "Leather Working" for instructions on making a number of articles, such as bags, portmanteaus, and cases, for which there is general employment and a consequently great demand. The two books just mentioned are issued uniform in style and price with the present work.

In this handbook it is proposed to treat the subject of harness making so fully that anyone possessing tact and sense can make a set of harness from the instructions given, or, at any rate, keep harness in good repair. A start will be made by describing the tools that will be necessary. In the list given below, every essential tool is specified and its uses explained. The tools are very numerous, but the amateur may dispense with many of them; for though all of them may have to be employed by a

tradesman in turning out finished work, an amateur may be content with a much smaller outfit. The tools are not bulky, however, and all that are necessary for making a double set of harness could be carried in a small handbag, excepting, of course, the mallet and collar-iron.

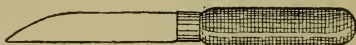


Fig. 1.—Paring Knife.

The tools are here classified as (a) cutting tools, (b) punches and tools of percussion, (c) tools for setting out, marking, and ornamenting, (d) awls and needles for perforating, (e) tools for gripping and holding work, (f) tools used in stuffing collars and saddles, and (g) miscellaneous. It may be remarked that saddlers' tools, as well as harness-makers', are included in this chapter.

With regard to cutting tools, a paring knife (Fig. 1) and a hand knife (Fig. 2) are used for cutting thread, paring down, and splicing, and are otherwise generally useful. The round knife (Fig. 3) is used by saddlers instead of the hand knife for cutting, splicing, and thinning leather; they can be had in different sizes, suited to light and heavy work; their chief use is in thinning the edges of leather,

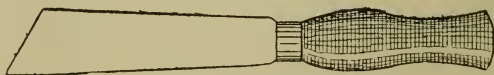


Fig. 2.—Hand Knife.

and for giving a rounded appearance to lined straps, such as nosebands, traces, breeching straps, etc. The head knife (Fig. 4) is used for cutting the holes for buckle tongues and cutting any circular shapes or holes in leather.

Fig. 5 is a cutting gauge made in iron or wood. A

knife passes through the ruled stem, and is held firmly by a screw. It is adjusted by shifting the block, which is also held by a screw.

A plough or plough gauge (Fig. 6) is very useful when much strap or belt cutting has to be done. By

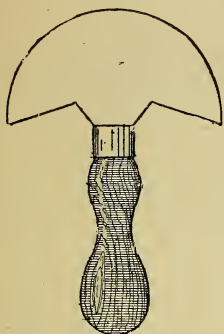


Fig. 3.—Round Knife.

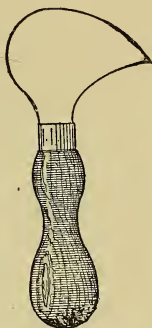


Fig. 4.—Head Knife.

means of it, straps can be cut from  $\frac{3}{4}$  in. to 4 in. wide, by sliding the knife backwards or forwards along the marked gauge. Straps can be cut much more quickly by this machine than by hand, and it quite dispenses with the use of the round knife and compasses. A slightly different plough is illustrated by Figs. 7 and 8.

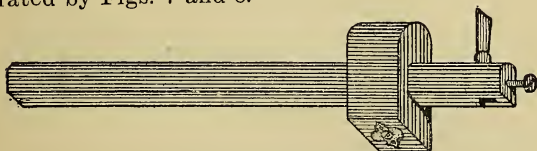


Fig. 5.—Cutting Gauge.

The slitting machine (Fig. 9) is useful for thinning straps which are to be drawn down to half or one-third their thickness. A saddler's spokeshave (Fig. 10) may be used for the same purpose as the slitting

machine. It is suitable for thinning light straps, and not only takes less time to adjust, but does the work more quickly than the slitler. The chief use

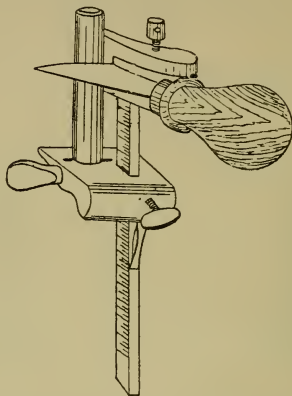


Fig. 6.—Plough, or Plough Gauge.

of the spokeshave, however, is to trim and finish traces, backbands, etc. After a trace or backband or other lined strap is stitched, the uneven edges require to be rounded and smoothed; this is done by clamping the strap between the knees, holding

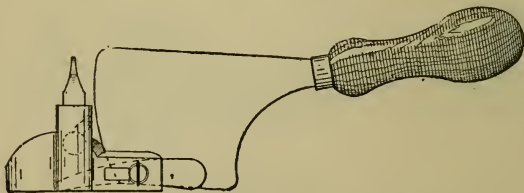


Fig. 7.—Side Elevation of Plough Gauge.

the clamp a little straighter than when stitching, and using the spokeshave.

Edge trimmers (Fig. 11) are for running along the

edges of straps of all kinds to take off the sharp edge and sides before dyeing. It is made in sizes 1 to 8.

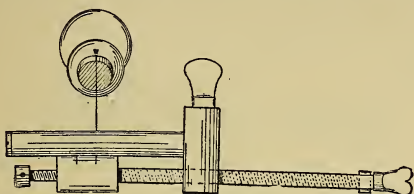


Fig. 8.—End Elevation of Plough Gauge.

Sharp and strong scissors are necessary for cutting linings, basil, and other kinds of thin leather. The

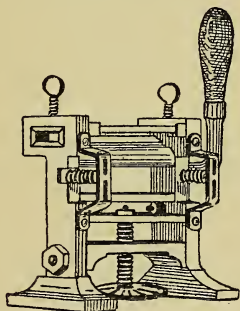


Fig. 9.—Slitting Machine.

washer cutter (Fig. 12) is used for cutting round pieces of leather by rule; the knife can be set at all sizes up to 6 in.



Fig. 10.—Spokeshave

Punches are indispensable, and half a dozen different sizes each of round (Fig. 13) and oval (Fig.

14) tools should be obtained. Round punches are made in sizes from No. 1, suitable only for very narrow straps, to No. 16, which make a hole  $\frac{5}{8}$  in. in diameter. Oval punches are numbered, according



Fig. 11.—Edge Trimmer.

to size, from 17 to 32, and make a hole of similar dimensions to the round punches just mentioned. Punches of intermediate sizes, Nos. 3 to 13 or Nos. 19 to 29, will, however, answer for most repairing jobs. The ovals are preferable in most cases, as they make holes in the straps large enough for the purpose without impairing the strength so much as the round ones do. Buckle tongue punches, or

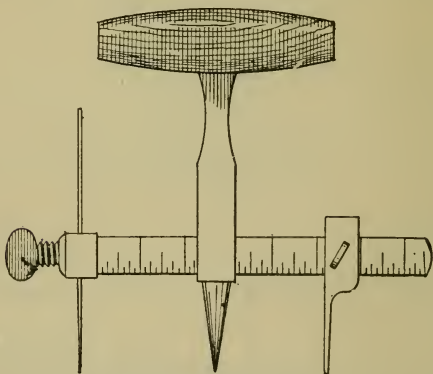


Fig. 12.—Washer Cutter.

crew punches (Fig. 15) are handy ; these are made in three or four sizes, and they run from No. 33 to No. 43, and are used for making the holes that take the heel of the buckle tongue when the buckle is


placed in its chape. This hole may also be made by punching two holes at a suitable distance from each other, and cutting between them, thus  The strap has to be bent and a hole cut through the



Fig. 13.—Round Punch. Fig. 14.—Oval Punch. Fig. 15.—Buckle Tongue or Crew, Punch.

bent end, the piece between the holes for the tongue of the buckle being afterwards cut out. The punches shown by Figs. 16 to 18 may be used to cut saddle girth chapes, brace ends, etc.

A hand punch (Fig. 19) is useful for punching holes in small straps, or for making holes in harness whilst it is worn by a horse. Saddlers are some-

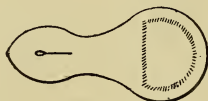


Fig. 16.—Girth Chape Punch. Fig. 17.—Brace End Punch.

times called upon to do this, and without a hand punch the work is awkward, necessitating the use of mallet, punch, and lead. Fig. 20 shows a loose

nipple which can be obtained in various sizes to screw in the handle.

Scalloping irons (Figs. 21 to 24), vandyke, round,

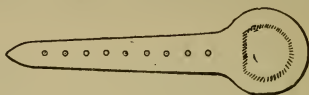


Fig. 18.—Forepart of Brace End Punch.

straight, and half-moon are used for cutting any fancy or ornamental designs in American cloth or fancy leather. Rosette punches (Figs. 25 and 26)

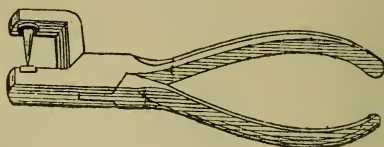


Fig. 19.—Hand Punch.

in sets of three or four, are useful for making rosettes in patent fancy coloured leather or for cutting out round scalloped edge pieces.

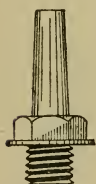
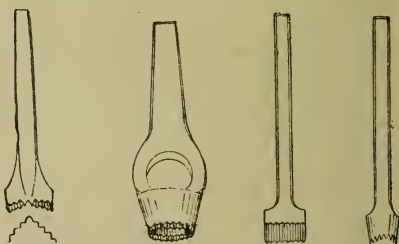


Fig. 20.—  
Hand Punch  
Nipple.



Figs. 21 to 24.—Scalloping Irons.

A lead piece (Fig. 27) for punching on should be from 6 in. to 8 in. square, and about  $1\frac{1}{2}$  in. thick. Lead is used because, being soft, it does not damage the points of the punches ; but if lead is not

handy, a block of wood 5 in. or 6 in. thick will do, if set up on end so that the punch does not cut across the grain.

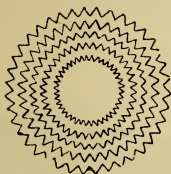


Fig. 25.

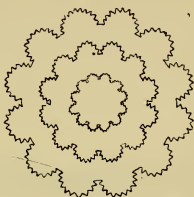


Fig. 26.

Figs. 25 and 26.—Rosette Punches.

A wooden mallet (Fig. 28) for punching is also required, and a lignum-vitæ round mallet to work the forewales and shape the stuffed bodies of



Fig. 27.—Lead Piece.

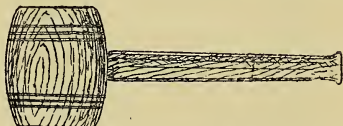


Fig. 28.—Wooden Mallet.

collars. Other useful mallets are shown by Figs. 29 and 30. Two hammers are necessary, one fairly light—the proper saddler's hammer (Fig. 31)—and the other a heavy one for heavy work.



Figs. 29 and 30.—Useful Wooden Mallets.

Tools for marking and ornamenting leather may now be mentioned. Fig. 32 shows a tool used in stamping the lines preparatory to stitching. These

tools vary in width from three teeth, which are used only for round points and scalloped work, to twenty-four teeth for straight lines. The teeth on each iron are cut to mark a certain number of stitches

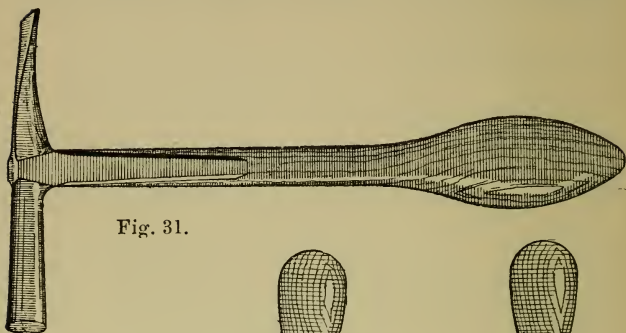


Fig. 31.



Fig. 32.



Fig. 33.

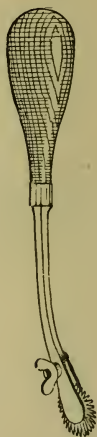


Fig. 34.

Fig. 31.—Saddlers' Hammer. Fig. 32.—Pricking-iron.  
Figs. 33 and 34.—Wheel Prickers.

per inch, from six to sixteen, and these teeth are not at right angles to the flat part of the iron, but are cut on the slant as at B, thus making an impression on the leather which acts as a guide in forming a stitch perfect in shape as well as in length.

Wheel prickers (Figs. 33 and 34) are used in sizes from seven or eight to sixteen teeth to the inch. They are round pieces of steel, having serrated edges and a hole in the centre, and are provided with a handle in which they are adjusted with a pin and nut. A change of stitch, say from fine to coarse, necessitates a change of wheel. The wheel is run along the stitching line, and in the holes made by the pricks the stitches are run.

The screw-race (Fig. 35) is a tool for grooving



Fig. 35.



Fig. 36.



Fig. 37.

Fig. 35.—Screw-race. Fig. 36.—Single Crease. Fig. 37.—Screw-crease.

lines in any part where it is desired to sink the stitches below the surface. It is easily adjustable.

Single creases (Fig. 36) are for marking in places where neither the screw-crease nor the compasses can go, as for instance, in the centre of a large piece of leather or wide strap. They are also used to mark thick and heavy loops, for which purpose they are heated before using.

Two screw-creases must be obtained, one light and the other heavy (Fig. 37); one is used for light lines and the other for heavy lines along the edge of

the leather, and for marking the lines for stitching. By means of the screw, the points are closed



Fig. 38.—Checker.



Fig. 39.—Beveller.

or opened, thus bringing the line nearer to the edge of the work or taking it farther away.

Checkers (Fig. 38) are small double creases with



Fig. 40.—Compasses.

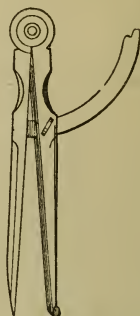


Fig. 41.—Race Compasses.

two parallel edges, one of which marks the small ornamental checked lines on loops ; one edge is run

along the last line done, which thus serves as a guide for keeping the lines parallel. Sizes 1, 2, and 3 will be sufficient. A brass foot-rule, of course, must be obtained.

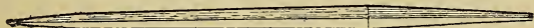


Fig. 42.—Awl Blade.

Bevellers (Fig. 39) resemble the single creases, but are much thicker and bevelled; they are used for the sole purpose of creasing or marking loops on portions that require ornamenting. In use, they are heated and then made to form a deep, wide groove on the loop, such as the straight cross lines on the front, and any fancy shapes worked on the outside of the loop.

Compasses (Fig. 40) should have a screw and regulator so that they may be set at different widths. They are used for marking the widths of straps to be cut and for marking distances, etc.

Race compasses (Fig. 41) are for the purpose of cutting a slight groove or line along the edges; they just take off a narrow strip of the grain and leave a faint line, which is blacked with the edges. It answers the same purpose as the line cut with the screw-crease, either ornamenting the straps or marking the line for the stitches.

With regard to perforating tools, a few awl blades (Figs. 42 and 43) and hafts may be obtained. Stitching blades vary in sizes from  $1\frac{1}{4}$  in. to 3 in. long.

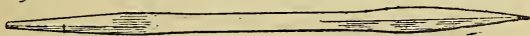


Fig. 43.—Awl Blade.

Hold the blade fast in the vice, and with a few sharp blows of a light hammer drive the haft or handle on the awl, which is then ready for use. Fig. 44 shows a sewing awl. Strong thick awls will be required for

coarse work, to stitch, say, a thread of seven, eight, or even more cords of hemp in one thread, and the thickness of the awl should diminish until the fine awl for stitching fine silk and cotton threads is obtained. Bent awls (Fig. 45) in one or two sizes,

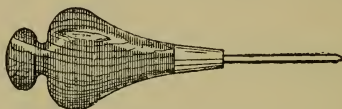


Fig. 44.—Sewing Awl.

such as shoemakers use, are employed for putting in wire in saddle flaps for fastening the panel ; they have other uses also.

Half a dozen packets of harness needles (Figs. 46 and 47), varying in size from No. 2 to No. 6, will be necessary ; the lowest number is the coarsest. These needles are for wax thread and all other stitching threads. Needles will also be required as follows:—2-in. or 3-in. needles for quilting saddle panels, etc. ; pointed needles for thimble work in stitching linings to saddle panels, etc. ; collar needles of different sizes, half-moon shape and straight with bent points ; these are from 3 in. to 6 in. long, the longest being for heavy cart collar work and the lightest for patent and light harness collars.

The seat-awl (two shapes are shown by Figs. 48



Fig. 45.—Bent Awl.

and 49) is for easing and levelling stuffing in collars, saddles, and other stuffed or padded articles. It is also useful for levelling thread ; this is turned once around the round awl, which is then drawn sharply

backwards and forwards, the lumps thus being taken out of the thread.

The hand- or palm-iron (Figs. 50 and 51) is a kind of thimble used on the palm of the hand when driv-



Fig. 46.



Fig. 47.



Fig. 48.



Fig. 49.

Figs. 46 and 47.—Harness Needles. Figs. 48 and 49.—Seat Awls.

ing collar needles through leather. A shallow honey-combed well is formed in the hand part, which prevents the needle from slipping, however great the pressure may be ; and at the end or point a hole is bored lengthwise, about  $\frac{1}{8}$  in. deep, to take the eye

end of the needle and force it closer to the leather when the broad part of the iron is not available

Holding and gripping tools include the clamp,



Fig. 50.

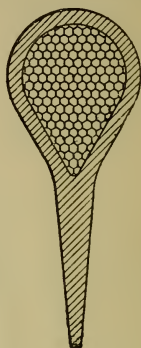


Fig. 51.

Figs. 50 and 51.—Hand-irons or Palm-irons.

known also as the pair of clams. Fig. 52 shows the ordinary type, while Fig. 53 is the kind used in sewing shaft-tugs. Held between the knees in a slightly slanting position, the clamp keeps the work firmly in position while the stitching is being done; it lies against the left knee, and by throwing the right leg over it the work is held fast between the gripping points. Note that the saddler has the clamp between his legs in a slanting direction, and not as the shoemaker, who has them straight up, almost



Fig. 52.—Clamp or Clams.

against his nose, when bending over the work. One reason for this is that the work done by the saddler with the clamp requires more force to press the awl

through than the work done by the shoemaker ; consequently the saddler must set his clamp against some firm object (his left knee) so that it will not yield under the pressure. Another reason is that

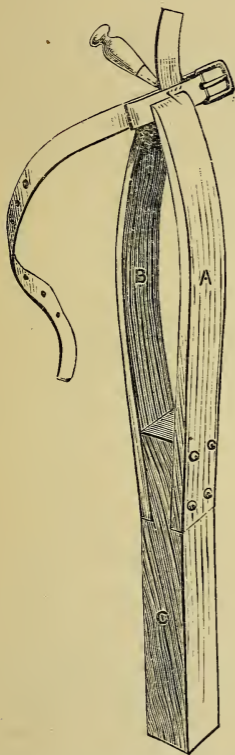


Fig. 54.—Home-made Clamp Holding Work.



Fig. 53.—Clamp for Sewing Shaft-tugs.



Fig. 55.—Jaws of Clamp.

the saddler stitches with needles, while the shoemaker uses bristles, and must see the hole made by the awl, as the bristles cannot force their way, as

the needles, to some slight extent, are able to do. The saddler feels for the hole with his needle and thus becomes accustomed to finding the hole without looking, and to getting his needle to follow the awl as the latter is drawn back; in fact, the needle is inserted in the unseen lower side with more accuracy than on the top side, which is in view.

A clamp can be made easily by the worker at home. The parts A and B (Fig. 54) are made from two oak cask or barrel staves. The lower portion C may be a sound piece of white deal, 20 in. by 3 in.



Fig. 56.—Nail-claw.

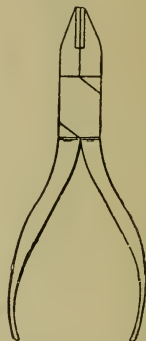


Fig. 57.—Cutting Pliers.

by 3 in., and the only other requisites will be eight stout  $2\frac{1}{4}$  in. screws. The staves should be cut 2 ft. long by at least 3 in. wide, the points of greatest convexity being in the centre; the more bent the staves are the more useful the clamp will be. Clean up the outside with a spokeshave, leaving one end the full thickness of the staves, or about 1 in., and thinning off gradually to about  $\frac{3}{4}$  in. towards the upper ends, which are to form the jaws of the clamp (Fig. 55). Round off the outer corners, and clean up the inside surface flat, smoothing both sides with glass-paper. The dovetail-shaped tenon

in the lower part c, should be at least 6 in. in length, and will require careful cutting, the depth of the shoulders and the width of the upper end depending upon the amount of curve in the staves



Fig. 58.—Iron Collar Rod.

which are to be attached to it. It should be borne in mind that the object is to embed the staves so firmly that their upper ends, or the jaws of the tool, press tightly together. With this object the tenon should be cut, so that energetic screwing will be required to bring the staves home into their final position. The screws should be countersunk flush with the surface of the staves.

A small wrench and a medium-sized vice will often be found useful. A nail-claw (Fig. 56) is required for pulling out the nails used to keep the work together. Pincers, nippers, and cutting pliers (Fig. 57) will be found useful as occasion demands.

An iron collar rod (Fig. 58) for stuffing the forewale must be obtained, as well as a hardwood stick, about 2 ft. 6 in. long, and having a V-shaped point, for filling the body of collars with straw; the stick



Fig. 59.—Steel Seat-iron.

is flat towards the V-shaped end, and round at the other end, the corners being rounded off smooth.

A steel seat-iron (Fig. 59) is used in putting flock into cart-saddle panels, but chiefly for stuffing the peak of riding saddles, as the tool bends nicely with

the shape of the saddle without tearing the cover or stretching it immoderately.

Loop-sticks (Fig. 60) are made of hardwood in various sizes to suit the width and thickness of the straps. A set made of hard boxwood or iron, varying in width from  $\frac{1}{2}$  in. to 2 in., and in thickness from  $\frac{1}{8}$  in. to  $\frac{1}{2}$  in., should be obtained. Less room is wanted in shaping a loop for a single strap than when a strap of two or three thicknesses is required to go through a loop. (A loop is the piece of leather placed crosswise on straps having buckles, and it keeps the point of the strap in its proper position.) A loop stick must be obtained that is thick enough



Fig. 60.—Loop-stick.

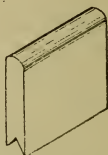


Fig. 61.—Rubber.

and wide enough for a trace  $1\frac{3}{4}$  in. wide and proportionately thick; there must also be one sufficiently thin and narrow for a  $\frac{1}{2}$ -in. strap; loop sticks for intermediate sizes are also necessary, and it is as well to get two each of some of the sizes. For instance, those things that are done in pairs, such as bridle-cheeks, shaft-tugs, etc., will require the use of two loop sticks of the same size. Good loop sticks are essential to turning out good work.

A rubber (Fig. 61) made of a piece of hard, close-grained wood or of thick glass about 6 in. square and V-shaped on one edge is used to smooth down two edges whipped together, or for flattening and levelling any two thin substances, such as leather and linen pasted or stitched together; it is also used to rub stitching on the underside of traces or any

double straps, and for rubbing or stretching damped leather.

The straining fork (Fig. 62) is sometimes employed for stretching wet webbing or leather, one end of which is nailed down and the other end strained with the fork and secured until dry.



Fig. 62. —Straining Fork.

A coarse file or rasp may be necessary to file down wooden and cane driving whip-stocks, etc., when putting on thongs and in splicing whip-sticks to level the splice so that both of the parts may lie flat against each other. A small round file and a small square one, as well as two or three coarser ones, are sure to come in handy. Amongst their uses will be the filing down of the brass or ironwork of saddles, and the making of holes in saddle trees, etc.

## CHAPTER II.

## HARNESS-MAKERS' MATERIALS.

It is now proposed to give some particulars of the materials used in saddle and harness making.

The threads used in the trade are many, but the principal is waxed thread, made by the saddler himself, and used to stitch harness and straps together. By waxed thread is generally meant thread dressed with black or cobbler's wax, but the saddler also uses thread dressed with beeswax and sometimes with white wax. The linen thread used is in various colours, yellow, red, black, white, etc., and is on reels or in hanks. Silk threads of the same colours are used for best work, such as stitching best brown saddlery, riding bridles, martingales, etc. The white and black linen thread is used for whipping-in lining in panels of both gig and riding saddles, and for stitching saving pads in any thin material for light work, and also in stitching along with the red and yellow thread in making riding bridles, and all kinds of brown light work. The hemp for wax threads, of various strengths, is to be had in black, yellow, green, and white. The white hemp is considered the best and toughest, though the coloured perhaps is a little cheaper. Fine No. 15 and coarse No. 3 will probably meet all requirements.

Beeswax, as already hinted, is used to make threads for work that is light as regards both colour and substance. Single linen threads of all colours are, before using, rubbed with beeswax, which does not deaden the colour. White wax is sometimes made for brown harness by melting together white-lead and white wax; instead of the latter, the wax from best white wax candles may be used. If the wax when cold is too soft, add more white wax; if too hard, add a little more white-lead.

Black cobbler's wax is made by melting together  $\frac{1}{2}$  lb. each of resin and pitch. When thoroughly mixed, remove the pan from the fire, and add one pennyworth of boiled linseed oil, or less, according to the weather. Thoroughly mix this with the other ingredients and then pour a little into cold water to test it. Let it remain for a minute and then remove it from the water, taking care to well wet the hands in doing so, or in the subsequent working it will stick to them. If it cracks when working it in the hands, it is too hard; if it pulls out properly and sticks well together, it is all right. Put it back into the water, and pour in the rest of the stuff after it. It is important that the piece tested be not put back into the pan containing the rest of the wax, as the water absorbed will evaporate and make the hot wax frothy and spongy. Gather the wax together in the water without loss of time, remove it with wet hands, and pull it fast hand over hand as quickly as possible till it attains a light golden colour. Pull off a small piece with the hands, or cut it off with wet scissors, and throw it into the water. If it floats on the surface it has been pulled enough; if it sinks, the wax requires more working. If not pulled enough, the wax is brittle, becoming tougher and better the more it is pulled. In making the wax it must be remembered that only half as much oil is required in summer as in winter. The colder the atmosphere the more oil will be required.

The quantities of ingredients mentioned will make about thirty handy lumps of wax, and as a rule a pennyworth of oil is enough in the coldest weather. If, after working it, the wax is too hard, melt it again and add more oil; if too soft, add more pitch and resin. Hard wax may be used in a way that avoids re-melting. The thread, previous to being dressed with the wax, is rubbed with tallow, over which the wax will run smooth. Cut the wax into lumps the size of a large pigeon's egg and keep it in water.

Directions will now be given for making wax threads. So that the hemp may be kept tidy and not mixed up with the tools on the bench, place the ball of hemp in a wooden or tin box having a small hole in the centre of its lid, through which the hemp can pass. Take hold of the end of the hemp with the left hand, twist it once around the fingers, and draw it through the right hand. When a sufficient quantity has been drawn out, break the thread by rubbing it on the knee to take out the twist, at the same time giving it a sharp pull; the strands thus loosen and break in a ragged end. Throw the hemp over a nail or hook in the bench, pull it until the sides are each about 2 ft. 9 in. long, keep the hemp tight with the end in the left hand, and with the right hand spin or rub it on the knee as before to untwist the strands; then pull it sharply to break it. The more ragged the broken end is the better will be the point on the finished thread. There is now one strand 2 ft. 9 in. long and pointed; with the right hand put the points together in the left hand, and draw the hemp again over the hook, spinning and cutting it as before, and repeating the operation till the required number of strands is obtained. The number varies with the required strength, from three to sixteen.

In putting the ends of the cut hemp together, do not leave them exactly the same length; by leaving some shorter than others a nice pointed thread is obtained at the finish, fine enough to go into the eye of a needle. When the required number of strands is obtained, take a ball of wax in the right hand, and hold both ends of the thread separately in the left; draw the wax over the points two or three times to keep the ends together, taking care to keep the ends on the left of the hook twisted round the left hand, and holding them tight with the third and fourth fingers, leaving the thumb and forefinger loose to manipulate the other end in the process of

twisting ; the wax on the ends or points is a great help at this stage. Having an end between the thumb and finger of the left hand, set it on the knee, and spin or twist it as when cutting the hemp. The knee should be raised about 12 in. from the floor by placing the foot on a support. Continue spinning with the palm of the right hand until the thread is twisted enough. If twisted too much, it will work into knots when used in stitching. Then put the twisted side round the left hand, kept firm by the third and fourth fingers as before ; and take the other side between the thumb and forefinger of the left hand, and spin it to the proper twist with the palm of the right hand as the other side was done. If the thread is required very smooth, twist both of the sides of the thread once round the seat-awl and draw the latter sharply backwards and forwards along the thread, all unevenness being thus smoothed away. For coarse work and repairs this is not necessary, but for best and new work the thread should always be smoothed.

To wax the thread, hold the two ends of the thread firmly in the left hand, and with the ball of wax held in the palm of the right hand, rub all along the thread, pulling the thread from around the hook into the open to enable that portion to be waxed also. Pull back the thread into its former position, and, with a piece of soft leather or the bare hand, rub the thread sharply from end to end to smooth the wax and make it even all along. The thread is then ready for use.

Yellow or white hemp thread is made with either beeswax or white wax in exactly the same manner, but the point of the thread is not dressed with white wax, being left unwaxed until the rest of the thread is finished. The end has to be pointed with black wax, which will not stick over beeswax or white wax. Black wax is the only kind that will keep the thread fast to the needles.

Nails are extensively used both in putting materials together for working and as ornaments. The nails used in putting work together are generally cut tacks, ranging in length from  $\frac{5}{8}$  in. to 1 in. Neat wire nails can now be had, however, much cheaper than the tacks, and are to be preferred, as they are of uniform size and leave a much smaller hole when withdrawn. Clumsy nails spoil good work, as the holes made by them are larger than the awl used in stitching. Very fine nails do not spoil the work, and can be obtained in sizes suitable for heavier and clumsier work; and they may be used over and over again if care is taken in pulling them out with the nail-claw. Cut tacks are used in putting gig saddles together, in nailing the leather to the tree, in adjusting panels in the gullet and behind, between the two prongs of the crupper staples, for nailing seats in riding saddles, etc. Cut tacks can be obtained as small as  $\frac{3}{8}$  in. in length.

Saddlers' tacks of different sizes from  $\frac{1}{2}$  in. to  $\frac{3}{4}$  in. long are used in putting in cart-saddle and riding-saddle panels and flaps, and for many other purposes. Clout nails are used now and then in putting houses on cart saddles, and for nailing on straps and girths, etc. Clout nails and saddlers' tacks are made of wrought iron. Round-headed and japanned nails may be used for nailing cart-saddle housings, and have a neater appearance than common iron clouts. Tough nails are used in making all kinds of saddles; they sometimes have heads covered with black patent leather, and sometimes japanned heads only. Others have heads of silver, nickel, or brass. They are used partly as ornaments and partly to hold the work together, and are in two sizes, cab and gig. There are usually four in a gig or cab saddle, one in each corner of the skirt in front and one on each side behind, holding down the binding that comes over the cantle of the saddle. The front ones are driven through, bent, and beaten close to

the tree backwards, whilst the hind ones are cut to taper for about half their lengths to a point; they are driven into the tree.

In a riding saddle there is one nail in the front, one in each of the sides, one in the corner of the skirts driven through and bent, and one on each side just at the thin end of the skirt, driven inwards so as to catch the tree and be flattened close to it. There is also one in each flap under the skirt in a line with the stirrup fastener, driven through the tree on the outside of the plate running along the points from the gullet; these are bent and flattened underneath. Sometimes brass nails are used as ornaments, but brass beading has done away with their use to a great extent. Formerly country cart saddles were ornamented by nailing the housing to the tree with brass nails; the covers of van saddles, as well as the opening over the boards, were also fastened down with these nails.

Such pieces as loop leather, the edges of black straps, etc., often have to be dyed. The dye or stain is made by boiling together for half an hour 1 lb. logwood chips, 4 oz. crushed nutgalls,  $\frac{1}{2}$  lb. copperas, a little gum arabic, and 5 qt. of water. Keep a little in an old bottle hung in a handy position near the bench. The dye is applied by a stick having a piece of felt attached to its end. The ink can be thinned by the addition of water. In dyeing brown leather, it must first be coated with soda solution to kill the grease. The solution is made by dissolving a piece of washing soda the size of a pigeon's egg in a quart of hot water. The black dye may then be applied. If it does not strike well, rub over it a coarse brush and again coat with dye. Rub it well and dry with a rag, afterwards well rubbing in a little tallow with either a rag or the bare hand. The tallow gives a finish and counteracts any injury the dye might do the hand, there being in the copperas a tendency to burn.

Flocks, both white and coloured, are extensively used in the trade, and can be bought at from 20s. to 50s. per hundredweight; the material can also be had in small quantities—even as low as a pound. Best white flock should be free from cotton, and should be tested by putting a small quantity in a candle flame; if cotton is present, it burns fiercely and with a big flame, but fine wool burns slowly and smoulders. The best flock is used for stuffing riding-saddle panels, etc., and the best drummed flock is used for collars, being put near the horse's breast under the lining to make the collars easy for the shoulder.

The drummed flocks are in large sheets, and these are cut to the size and shape required, and, being of even thickness, will not be lumpy, an important consideration in making a collar. Coarser flock of a white, brown, or any dark colour will do for stuffing and restuffing gig-saddle panels. Curled horsehair is sometimes used for stuffing panels, and is found very cool for an animal with a tender back or shoulder; goat hair is very suitable for stuffing. Neither this nor horsehair is so liable to be clogged by sweating as sheep's wool, though the latter, when dry, containing but very little oil and being well carded, is used extensively in country places.

All these materials before use should be put through the flock machine once or twice to loosen the fibre, and care should be taken when stuffing with a rod that the flock or wool is not put in lumpy or uneven. After stuffing, the work should be levelled with the seat-awl until it is as smooth as a board. The drummed flock, of course, is already level and even; it is not stuffed in, but laid on the inside of the collar lining before stuffing the collar with straw.

Thick felt is a good substitute for pads to ease collars and saddles, and can be bought in various thicknesses by the pound. Large cuttings and

waste pieces can also be bought very cheaply, and two thicknesses can be put together if necessary, a strap and a buckle being on one side with a strap on the other to fasten to a saddle or collar. Felt is useful to put under cruppers and to line breechings when chafing, or under any strappings that chafe the horse's skin. They can be fastened to the above by stitching them with a spot stitch, thus - - - -, about  $\frac{3}{4}$  in. apart, and slanting the awl underneath to make the stitch small there as well as on the top ; or nails may be used when the felt is sufficiently thick. False collars, pads to be used like saddle cloths under gig or cab saddles and under cart-saddle panels, riding-saddle cloths, and many other articles are made of felt.

The harness maker and saddler uses many different kinds of leather, and, unless the worker possesses some knowledge of the particular purpose of each variety, much waste is likely to result. Stuff too light or too heavy, too thick or too thin, spoils a job, and of course entails loss.

In Fig. 63, which is a diagram showing a cut hide, A A show the sides of a harness hide with belly on ; C C, backs of harness hide with belly off ; B B B B, bellies of hide ; D D, middlings ; E, shoulder ; and F, uncut middling.

Harness leather can be bought in hides (A A) cut only along the back, having the belly part attached, at the rate of from 1s. 2d. to 1s. 11d. per lb. The best part can be used for harness and cart gear ; the belly will come in well for repairs, linings, and fillings. Harness backs (C C) are half hides from which the belly (B B) has been cut off ; these have all pure firm leather suitable for making all kinds of harness. The price is from 1s. 9d. to 2s. 5d. per pound.

Trace backs (C C) resemble the above, but are picked and more carefully dressed, and are made of the finest and best grown hides. They cost from 1s. 10d. to 2s. 7d. per pound.

Rein hides have the bellies attached but are dressed and of picked quality and thickness and uniform strength; they are suitable for making into driving reins. For the best part can also be made any good light single straps, where strength and durability are required. The best part of the belly can be cut up into small straps of any kind and into linings. These hides cost from 56s. to 72s. each. Rein backs resemble the above, but have the belly cut off; the price is from 40s. to 70s. each.

Black strap butts (D D) are the best part of the hide from which the belly and shoulder have been cut. They are from 4 ft. 6 in. to 4 ft. 9 in. long, and are suitable for any kind of good single strap. The price is from 56s. to 72s. a pair.

Black spur shoulders (E) are light shoulders dressed and flattened; from them are made spur and similar straps, garters, wrist straps, etc. The price is from 8s. 6d. to 10s. each. Japanned horse hides for patent harness collars cost from 40s. to 46s. each. Cow hides, japanned for the same purpose, cost from 38s. to 44s. each. Japanned cow-backs for collars, etc., cost from 30s. to 39s. per pair. Japanned flap hides for making gig, cab, or brougham harness saddle flaps are priced at from 2s. 3d. to 2s. 6d. per pound. The middlings cost from 2s. to 2s. 6d. per pound.

Winker hides, japanned for making bridle winkers, cost 54s. to 56s. each, and the middlings (F) for the same purpose cost from 32s. to 36s. per pair. Japanned welting seals for making welts for gig saddles, etc., are priced at from 7s. 6d. to 8s. 6d. each. Japanned and enamelled hides for making military belts, etc., cost from 54s. to 60s. each, and middlings for the same purpose from 40s. to 42s. per pair.

There is great variety in brown or stained leather. Bridle hides for all sorts of riding bridles cost from 50s. to 56s. each. Backs (C C) from the above cost

45s. to 50s. each, whilst the butts cost 32s. to 40s. ; these are in varying qualities and prices.

Brown shoulders (E) dressed for coat straps, garters, braces, or small straps in general can be bought at from 6s. 6d. to 10s. each, and driving-rein brown hides at from 56s. to 72s. each. The backs cost from 56s. to 66s. a pair, and the butts for hand-parts of reins 38s. to 42s. a pair.

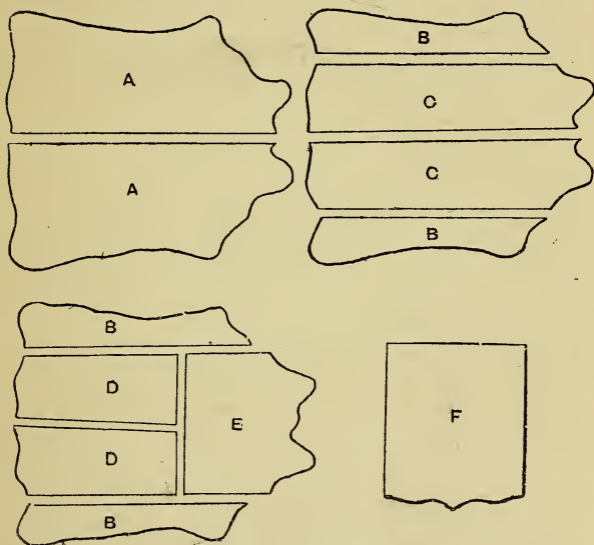


Fig. 63,—Cutting up Hide.

Double-rein hides—that is, brown leather specially selected and dressed for making reins of double thickness stitched together, cost from 44s. to 50s. each. The backs cost from 40s. to 48s. per pair. Head-collar rein backs for making head-collars, stallion bridles, etc., can be bought at from 2s. 6d. to 2s. 11d. per pound.

Stirrup hides for making stirrup straps cost from 2s. 6d. to 2s. 9d. per pound ; there are also inferior qualities. Butts for stirrup straps cost from 3s. 6d. to 4s. per pound. Brown harness hides cost from 1s. 6d. to 1s. 11d. per pound. The backs cost from 1s. 8d. to 2s. 2d. per pound. Skirt hides for making ladies' and gents' saddle skirts and flaps are priced at from 1s. 10d. to 2s. 2d. per pound. Skirt backs are from 2s. to 2s. 4d. per pound, and shoulders, 1s. 5d. to 1s. 10d. per pound.

Hog-skins suitable for all purposes, but chiefly used for saddles, can be bought at from £9 to £12 per dozen ; they can be bought singly, and there are also inferior qualities.

Sheep-skins in imitation of hog-skins can be bought at from 30s. to 60s. per dozen, or copper plates for printing basils and a printing press for the purpose can be bought instead. Basils for gig-saddle panel pads and repairing collars, and cart-saddle cheek pads, etc., can be bought at from 10s. to 30s. per dozen. The common ones are good enough for repairs and cheap work.

Specially dressed hides for making braces or any light straps can be bought at from 36s. to 40s. each ; the shoulders (E) or bellies (B) dressed for the same purpose can be had apart from the hide. Purse and pocket-book hides are also specially dressed, and cost from 30s. to 40s. each. Calf-skins dressed for the same purpose cost from 9s. to 10s. 6d. each. The brace and pocket-book and purse leather can be obtained stained in various colours, red, brown, yellow, orange, etc. The brown harness leather also can be had natural or tallow colour or stained fawn, nut brown, yellow, or orange. Brown gear hides for cart work are from 1s. 3d. to 2s. per pound, the backs from 1s. 7d. to 2s. 3d. per pound, and bellies from 10d. to 1s. 4d. per pound.

Mill bands for making driving belts cost from 1s. 6d. to 2s. 2d. per pound. Engine butts for mak-

ing strong engine belts, either single or double, cost from 2s. to 2s. 6d. per pound.

Fancy coloured leather for bridle fronts and rosettes cost from 40s. to 42s. each middling. Striped patent frontings leather costs from 1s. 6d. to 2s. 9d. per square foot. White buff hides for hunting-crop keepers, razor strops, belts, etc., cost about 5s. per pound. White bleached buff middling is about 5s. per pound.

A country saddler is often called upon to work in coach-builders' leather; leathers for this purpose are not included in the above list, but, as a rule, they can be obtained at the same place as harness leather.

Enamelled cow, ox, and bull hides for carriage tops, etc., are sold whole, and not slit along the middle, at from 40s. to 70s. each. Coach hides and backs for dashes and wings cost from 26s. to 40s. each. Seal-skins for the same purpose cost from 7s. 6d. to 12s. each. Hides for window straps, enamelled and prepared, cost from 56s. to 60s. each. All coloured carriage cushion hides for making carriage cushions cost from 40s. to 60s. each. Dyed and enamelled leather for cushions is sold by the square foot.

It is scarcely necessary to state that all the above prices fluctuate with the market. A great quantity of harness leather, nowadays, is prepared by the quick tanning process, but it is inferior stuff. The best leather is that which has been through a pure oak tan. It is very hard, however, to tell when the inferior process has been used, but as a rule the colour, smell, and even taste of the leather decide the question; soft, mellow leather that has not a hard feeling to the touch is as a rule good leather, especially if it has a close grain and a light yellow colour when cut. The inferior quality feels and looks dry and hard; it has a dull grey colour and an uneven grain facing. A good test is to bend it,

poor and badly dressed leather cracking in the bend, and the grain giving way ; these defects show that either chemicals or excessive heats have been used in the finishing and tanning. Well tanned and dressed leather stands the bending test well.

A few rules on cutting up hides may now be given. When cutting a strap from a hide, do not cut down lower than the width of the strap required, so as not to interfere with the next cut into the hide. All possible care should be taken to prevent waste, and pieces of particular shape should be cut from a pattern. It is sheer waste to cut off a piece of stuff larger than is required and then to trim it down. In cutting up a hide, lay it on the bench with the back part against the worker ; use a straightedge at least 8 ft. long, and mark with a blunt-pointed awl or the seat-awl, using the straightedge as a guide. Take care not to cut the grain of the leather with the point of the awl, as in the case of the straightedge being shifted an indelible mark may be left.

If the strap is to be cut with the round knife, set the compass to the right width, and put one point in position to run along the edge of the leather, and the other on the leather so that it marks the width to be cut ; pull the compass towards the worker, pressing it so that it leaves a plain line. With the round knife begin cutting at the right-hand end, keeping the leather steady in its place on the cutting-board with the left hand. A cutting-board ought always to be employed, as nails on the top of the bench would interfere with the work. Push the knife along the marked line steadily, taking care that the knife does not slip ; if it does, it may make a bad slit and spoil the work. Straps are always cut along the hide and not across it, the hide being much stronger lengthways.

The first cutting from the hide is suitable for reins, and then in order come traces, back-bands, bridg-

ing-straps, hip-straps, and hip-strap tugs; then crupper billet, shaft tugs, name tugs, bellyband, bridle head-strap, cheeks, etc.; and from the belly part or third quality in side of hide may be cut linings and layers for folds. In making cart harness, cut bridge-band, crupper, and bridge-band carrier or hip-straps and bearers, and then cart-saddle bellybands and bridle; the best part of the belly, with the top well lined, will do for side pieces of collar, unless this can be cut from a specially dressed piece.

Specially curried leather must be obtained for cart-saddle housings and winkers, as the harness leather is not firm enough and contains too much oil. The special leather also must be got for the saddle flaps, the pieces lying against the ribs of the horse under the ridgworth.

A leather that is cheapest in first cost is not always the cheapest to use. That leather is the best from which the greatest weight of firm straps can be made, and which will continue firm for the greatest length down towards the belly part.

The compass and round knife only were mentioned in the description of cutting straps, but the plough is very useful for cutting straps varying from  $\frac{1}{2}$  in. to  $5\frac{1}{2}$  in. in width. The plough does away with the use of both compass and round knife, and cuts much more evenly and straight than it is possible to do by hand. Its use effects a great saving of time, the knife merely requiring to be adjusted on the gauge and made fast by the thumb-screw. Hold the leather firm and flat on the board with the left hand, and press it forward to the plough, keeping the guard close and tight to the edge all along. The uses of the head knife in cutting will be fully explained later.

Brown harness work, as small straps, traces, back-band, and breechings, may be finished with a thin solution of gum and water, and should be well

rubbed with a smooth bone until polished. Machines for trimming the edges are made, but their work is incomplete, because all lengthy straps have parts in which the fibres are less close than at others. A good method is to knock the edges all along, consolidate them as much as possible, and then trim them round and level with the spokeshave; afterwards run a glass scraper over them and sandpaper. Finally, a good rubbing with brown paper and bone, after gumming, will give a fine polished edge to all brown work.

Black straps and harness are prepared in the same way for polishing; black dye them, then rub dry with a rag, and polish with brown paper and bone. Sometimes, after blacking and rubbing, a coat of liquid blacking is applied, and rubbed until dry. Again, some harness-makers employ black-ball and a burnisher to finish after blacking, rubbing down well; this is recommended for the best harness. It should be understood that whenever the word finishing is used here in connection with best harness this process is referred to for black and brown harness and single straps.

Common harness and cart gear, especially in country places, are usually finished by levelling the edges, scraping with glass, blacking, rubbing with a rag, and finally, after passing a ball of hard tallow along the edges, rubbing with a bone or hard knife handle.

Webs are used for a variety of purposes by saddlers. Girth web for making saddle girths is sold in 15-yd. pieces. It can be had in cotton, union, or worsted. Race girth is a superior material for racing saddles; it is about 5 in. wide. Web for roller girth is from 4 in. to 6 in. wide and in  $12\frac{1}{2}$ -yd. pieces; it is of cotton, union, or worsted. In the same material is made trace web in  $18\frac{1}{2}$ -yd. pieces,  $1\frac{1}{2}$  in. to  $2\frac{1}{2}$  in. wide. Game-bag web is sometimes required, and is bought by the yard in different

colours. Men's body-belt web is to be had in 18-yd. pieces from 4 in. to 8 in. wide, and in seven or eight colours. Straining-web for saddle seats can be bought by the yard or in the piece. A country saddler finds diaper-web very useful ; this is bought in 15-yd. pieces.

Other requisites, such as bits, spurs, stirrups, and harness furniture are described in Chapter X.

A few reliable recipes for some of the most necessary articles employed in harness making will now be given.

*Iron Liquor for Dyeing.*—(a) Green copperas, 2 lb. ; vinegar, 2 qt. ; pulverised nutgall,  $\frac{1}{4}$  lb. ; and water, 4 qt. Two weeks after mixing add another 2 qt. of water. (b) Bichromate of potash,  $\frac{1}{2}$  lb. ; logwood extract, 1 lb. ; copperas, 1 oz. ; and water, 1 gal.

*Saddlers' Black Wax.*—(a) Pitch, 2 lb. ; resin,  $2\frac{1}{2}$  lb. ; seal oil, one pennyworth. In winter add 2 lb. of resin instead of  $2\frac{1}{2}$  lb., and never more than  $\frac{2}{3}$  of the oil until the stiffness of the wax has been tested. (b) Pitch, 1 lb. ; resin, 1 lb. ; and linseed oil, one pennyworth.

The exact amount of oil to be used in both of the above recipes depends on the season and the weather. A little lampblack may be well mixed in when the wax is required very black. Always melt the pitch and resin together, and then add the oil. Afterwards pour the mixture into cold water, and knead and pull it until it floats. Try a small piece first to ascertain whether there is sufficient oil, and likewise after pulling to see whether it floats.

*Brown Wax.*—Beeswax, 1 lb. ; pale resin, 3 oz. ; and white-lead, 3 oz. The wax can be softened or hardened by adding more or less beeswax. Melt the mixture, stirring it, and then pour it into water and pull until it floats.

*Flour Paste.*—Water, 1 qt., and alum 3 oz. Heat until the alum has melted, and when cold add flour to the consistency of cream ; then let the mixture

boil, stirring it at the same time. By adding a little powdered resin and a clove or two before boiling, the paste will keep for a year and can be softened with water when dry.

*Brown Stain.*—Boil equal parts of pine and alder bark in six times their bulk of water until the colour is extracted, and when cold add a little alcohol.

*Yellow Stain.*—Boil some fustic berries in alum water and darken the shade by adding powdered brazil, which must be boiled with the berries.

*Brown, Russet, and Yellow Stain.*—Boil a given amount of saffron in water until the colour is extracted, cut a quantity of annatto, putting it into urine, and mix the urine and extract, the proportion of each determining the shade; the greater the amount of annatto the darker the colour.

*Stain for Riding Saddles, etc.*—Saffron, three pennyworth; annatto, one pennyworth; soft soap, one pennyworth; and boiling water, 1 qt. Mix and let the whole stand until ready.

*Reviver for Patent Leather.*—Mix warm linseed oil 1 pt., and cream 1 pt. Apply with a sponge and polish with a soft flannel or rag.

*Harness Composition.*—(a) Glue, 4 oz.; gum arabic, 3 oz.; water,  $\frac{3}{4}$  pt. Dissolve all by heat and add 6 oz. of treacle and 5 oz. of very finely powdered ivory black, and slowly evaporate with constant trituration until the composition is of the proper consistency when cold. When nearly cold, bottle and cork; if necessary the bottle can be warmed before use. (b) Mutton suet 2 oz., and pure beeswax 6 oz. Melt this mixture and then add finely powdered sugar candy, 6 oz.; soft soap, 2 oz.; lampblack, 2oz.; and finely powdered indigo,  $\frac{1}{2}$  oz. When perfectly incorporated add  $\frac{1}{4}$  pt. of oil of turpentine. Keep the composition in pots or tins. (c) Beeswax, 1 lb.; soft soap, 6 oz.; ivory black,  $\frac{1}{4}$  lb.; Prussian blue (ground in), 1 oz.; linseed oil, 2 oz.; and oil of turpentine,  $\frac{1}{2}$  pt. Mix well together and pot. Put a

thin layer of one of the above on the leather and polish gently with a brush or rubber.

*Harness Jet*.—Molasses, 8 parts; lampblack, 1 part; sweet oil, 1 part; gum arabic, 1 part; isinglass, 1 part; and water, 32 parts. Mix well together and add 1 pt. of turpentine. Apply the mixture with a sponge. If it is hard, place the bottle in hot water to soften the mixture. One ounce of spirit of wine can also be added when cool.

*Waterproof Paste for Carriage Harness*.—(a) Dissolve three sticks of black sealing wax in  $\frac{1}{2}$  pt. of alcohol, or dissolve lac in alcohol and colour with sufficient lampblack. (b) Melt 2 oz. of black resin in a glazed vessel over the fire, and then add 3 oz. of bees-wax, and as soon as all is melted remove from the fire and add  $\frac{1}{2}$  oz. of fine lampblack and  $\frac{1}{2}$  oz. of Prussian blue in powder. Stir all well and add enough turpentine to form a thin paste. Cool and apply with a sponge; polish with a soft brush.

*Oil for Farm and Team Harness*.—Melt 3 lb. of pure tallow without letting it boil, and gently add 1 lb. of pure neatsfoot oil. Stir continually until cold, so that it will be perfectly mixed, otherwise the tallow will harden in lumps. To colour, add a little bone black or lampblack.

*Brass Polishing Paste*.—(a) Dissolve 3 parts of oxalic acid in 40 of water, with 100 of pumicestone powdered, 2 of oil of turpentine, 12 of soft soap, and 12 of any fat oil. (b) Beat equal weights of soft soap and rottenstone into a paste.

*Plate Powder*.—Take as much sulphate of iron as will fill a clay pipe, keep it on the fire for a quarter of an hour, and mix with powdered chalk.

*Leather Preserver*.—To preserve harness from the effect of ammonia in stables add a little glycerine to the oil employed.

*Leather Cement*.—(a) Dissolve guttapercha in bisulphate of carbon until of the consistency of treacle. Shave well the parts to be cemented and

then spread a little cement evenly over them. Warm them for about half a minute, apply one against the other quickly, and press hard. Keep the bottle well corked and in a cool place. (b) Melt gutta-percha, 16 parts ; pure rubber, 4 parts ; yellow pitch, 2 parts ; shellac, 1 part ; and linseed oil, 2 parts, and apply as above. (c) Guttapercha, 1 lb. ; indiarubber, 4 oz. ; pitch, 1 oz. ; shellac, 1 oz. ; and linseed oil, 2 oz. Melt all together. The composition will harden when kept, and must be melted for use.

*Bronzing for Leather.*—A small amount of so-called insoluble aniline violet is dissolved in a little water and the solution brushed over the article ; it will dry quickly. If the result is not satisfactory, repeat the process.

*To Gild Calf- or Sheepskin.*—Wet the leather with some egg albumen, and, when dry, rub it with the hands dampened with a little olive oil. Then apply the gold leaf, and pass a hot iron over it.

## CHAPTER III.

## STRAP MAKING AND STITCHING.

INSTRUCTIONS have been given on making threads and cutting leather, and now a simple exercise in stitching may be given in the putting together of small straps.

In making a box strap, cut with the round knife or plough from the back of the hide a good piece of leather, which should be 6 ft. long, and  $1\frac{1}{2}$  in. wide. Turn down about 2 in. of one end, cut a hole within about  $\frac{1}{4}$  in. of the bend, and slit the part out with two cuts. Neatly shave down the point of the under piece with the round knife, and slant the other end a bit at each side to make a neat point to enter the buckle easily. Run the No. 1 edge tool along the sharp edges of the two sides and of the top and bottom; this takes a small strip off, rounds the edges, and produces a better finish. If brown leather is used, wipe the edges with a damp sponge; instead of pure water, a very thin solution of gum may be used. Then rub the edges with a rag or with a piece of brown paper until they are smooth and polished.

Adjust the screw-crease so that it marks a line about  $\frac{1}{8}$  in. inside the edges, warm the crease in a gas or candle flame, and rub it sharply all along the edge, guiding the crease mark on the strap by keeping the other side of the crease close up to the strap. Rub backwards and forwards until there is a deep polished mark on the strap, then mark across the point in the same way. This operation is known as creasing.

Two crease marks instead of one may be made after turning the thumb-screw to widen the points of the tool. Then cut a piece to form a loop about

$\frac{3}{4}$  in. wide and long enough to go round any part of the strap and make the ends meet. Edge this in the same way as the strap, polish with dye or water according to colour, and then crease.

For a running loop—one that runs loosely along the strap—the leather about  $\frac{1}{2}$  in. longer than twice the width of the strap so as to overlap; shave one end on the top or grain side, and the other on the bottom or flesh side, so that when jointed the pieces will make an even thickness. Allow sufficient length for the two thicknesses of strap to go through, and mark where it is to overlap. Put one side of the doubled part in the clamp and stitch the side opposite, then reverse it and stitch the other; all running loops are made in this way except for very common straps, when the strips are simply brought end to end and a stitch or two is made from side of the doubled part in the clamp and stitch the buckle, put the tongue point of the latter through the hole made for it in the strap, and having marked the stitches eight or ten to the inch with the wheel-pricker on the short underpart, put the loop in between the two leathers deep enough for the stitches to hold firmly. Begin stitching by the buckle, putting a cross stitch downwards close to it. Stitch the straight row along the line of marks close to the buckle end, and have a stitch over; do not pull the thread up at the last stitch, but have both the ends underneath. Put two or three stitches in the centre at the point; here also the last stitch is downwards. Then begin stitching the other side. With the awl put the first hole close to the point and pull the thread through; make the next hole and put the other thread up and the top one down, and so on until the loop is reached. See that the loop is of the right length; if too long, cut a bit off. Put the point in between the two leathers, deep enough to catch the stitches, and put one or two stitches in the side next

to the thread, slanting the awl a little outwards at the point. Put the upper needle through the loop so that the stitching will not be over it, and have a stitch or two in the side of the loop next to the worker ; finish it up to the buckle. Put a cross stitch at the finish, the same as on the other side, and cut the thread. Put a loop stick of the same width and thickness as the strap through both loops, hammer them lightly to shape, and run the warm single crease along the edges. With a punch of the right size cut the required number of buckle holes, beginning about 5 in. from the point ; make the distance between the holes a little more than the width of the strap. This is always the rule in punching single straps, such as garters, cart hame straps, dog muzzle straps, luggage straps, etc.

With regard to threading the needles, a properly made thread will have a nice point, which must be well waxed, and pulled between the finger and thumb two or three times to warm the wax so that it will stick. Pass the end through the eye of the needle for from 1 in. to 2 in., according to the fineness of the point, and holding the thread between the finger and the thumb of the left hand, spin it from you with the finger and thumb of the right hand. Afterwards draw the thread from the needle downwards at the point between the fingers so as to stick the point together well and make it smooth. Take care not to put it too far through the eye, or it will be too thick to go through the holes in the leather, while if it is not pulled through far enough the thread is liable to break. Be careful also to get needles of proper size ; light thread for light work and strong thread for thick and heavy work ; and a fine awl for fine thread, and a coarse and strong one for coarser thread, and so on.

In making the first hole in stitching, put the needle and thread up from underneath, and draw exactly half of the thread through. Put both

needles together and adjust the lengths of the two portions of threads, and with the awl cut the second hole, and stitch on. Always put the lower thread in each hole first and draw it up about 3 in., then put the other needle in and pull, always keeping the thread from below lowest in the hole and the top thread above. This is managed by pulling with the upper hand a bit downwards, and with the hand at the back of the work a bit upwards, thus tending to keep the stitches in position. It may be noticed that the hole is not round, but square and elongated, and tends to help the manipulation of the thread. Do not make a practice of pushing the awl through the work at right angles to the face, but on the slant; the holes made by the wheel-pricker are all on the slant. The above instructions also apply to double-thread stitching, the kind mostly used in harness making, though many things, such as the straps, described above, are stitched with single thread.

In back stitching, use one thread only; begin by putting it up from below; put it down backwards in the next hole to the one last made, and then pull it tightly from below. There is not much difference on the top side, but the stitches on the underside are twice as long and cross each other in chain fashion. Sometimes it is convenient to adopt this method to use up waste points, etc., but such things as traces, surcingles, waist-belts of web, saddle girths, etc., are always stitched with single thread. When repairing inferior harness, single thread can sometimes be used without stitching backwards, by doing what is called spotting, that is, always going forward thus / / /, and only up and down forward, the stitching appearing like spots, and not as an unbroken chain.

Stitching with white lace in cart work is done in this manner:—Put the holes on the upper side very close together, but underneath; the distance apart

may vary with the fineness of the work. This kind of lace stitching is not much in vogue now, but it looks well when across the end of breechings for cart purposes, across the openings in cart cruppers, etc. Lace needles and white skin will be necessary for this work.

Riding bridles and almost all light brown work are stitched single thread and backwards, with either white linen, cotton, or silk beeswaxed, or sometimes with yellow fine hemp thread beeswaxed.

Dog-collars are made in a similar way to the straps previously mentioned, only the bend is made a little longer underneath to allow sufficient lining under the D to which the chain may be fastened.

Now that an insight into stitching has been obtained, the making of a waist-belt, Figs. 64 to 65,



Fig. 64.—Plain Waist Belt.

may be described. Cut the web so that its ends meet together round the waist, and also cut pieces of very thin belly brown leather or basil, for binding the ends; the latter should be about  $1\frac{1}{4}$  in. wide, and as long as the webbing is wide. Turn down the binding along the centre lengthways, hammer it lightly, and with the screw-crease mark along one side; then slip it in both sides of the ends of the web, and either put a tack or two in it, to keep it in place, or paste it down. Allow the paste to dry before proceeding further. With the wheel pricker along the crease mark the stitches, about ten to the inch, then put the web in the clamp, the latter being between the knees, and begin stitching at the end farthest from the worker. Use one yellow or

white linen thread dressed with beeswax. On coming to the end, cut the thread ; also cut the binding square with the edge of the web and stitch both ends across at some distance from the edge.

Prepare the pieces to be put over the straps and chapes ; cut them about 3 in. wide, and straight on one side, making any fancy cut on the other ; two of these pieces are wanted, one at each end. Then cut the straps and chapes, and use light tinned bridle buckles or brown covered buckles  $\frac{7}{8}$  in. wide. With the compasses set to the right width, mark out the straps on a close piece of brown shoulder or belly leather. Cut the straps about 6 in. long and the chapes about  $2\frac{1}{2}$  in. long. They may be cut in long strips, being afterwards divided into the re-

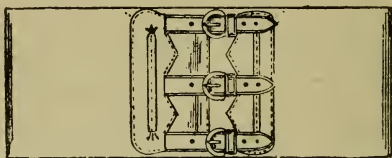


Fig. 65.—Fancy Waist Belt.

quired lengths. Form the strap, point one end a little, and shave the other end to go under the pieces above mentioned ; rub the edges either with water or solution, and crease them about  $\frac{1}{16}$  in. from the edge. Then turn down the chapes for the buckles, shave down both ends thin, and let the lower one be a little shorter than the other. Punch a small hole about  $\frac{1}{4}$  in. from the end, cut the hole clean out at the bend, and the piece is then ready for the buckle.

Use thin brown waste to make the loops ; with the compasses mark a width of this about  $\frac{3}{8}$  in., cut to the right length ; then rub and crease the chapes. Place the buckles in the leather, put in the loops about half the width of the chape between the two

points of the chape, and close to the buckle, and put two or three stitches in each end. The pieces to hold up the belt firmly at the small of the back should be about 1 in. wide. Rub the edges and crease them as well as the two pieces for the front, and mark stitches with the pricker in all of them. Three of these back supports will be needed, one right across the centre of the belt and one on each side, 3 in. from the centre at the top and slanting inwards to within  $1\frac{1}{2}$  in. from the centre at the bottom.

To determine which is the lower and which is the upper side of the belt, bear in mind that, when being worn, the buckles will be on the left-hand side and the straps on the right. Put one of the 3-in. wide

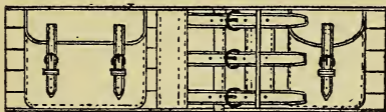


Fig. 66.—Waist Belt with Pockets.

pieces flat on the belt, within about 3 in. of the end, and either paste or tack it in its place from the lower side. Put the straps in about  $\frac{3}{4}$  in., all three exactly alike, one in the centre, and the others one on each side within  $\frac{1}{8}$  in. of the edge. Place the other piece in the other end so near the edge that, in putting the buckle chapes up to the loops under the edge of the piece, the outer edge of the buckle is flush with the end of the belt. Fasten the chapes in position exactly opposite the straps in the other end. Then backstitch the pieces in each end all round, in the same way as the binding was treated. Put a second row of stitches farther in than the first, through the strap ends and through the end of the chapes; leave about  $\frac{1}{2}$  in. between two rows, and then lay on the back straps. Having pricked them, stitch them in the same way as the others. If

pasted on, they can be kept more easily in their place ; if pasting is not convenient, pencil on their positions and keep them to the mark in stitching.

It is usual to put a piece of whalebone or good hard cane inside these to keep them up ; thin the bone or cane and push it in between the leather and webbing from one end, and then stitch both ends across. Put four or six holes in the straps and see that they work easily in the loops, when the belt is finished.

## CHAPTER IV.

## LOOPING.

SOME hints on looping will be given in this chapter. The loops are pieces of leather placed crosswise on all straps, which have buckles, to keep the point of the strap in its proper position. Sometimes also loops are employed merely to hold the straps in place, as for example in the case of shaft tugs. Loops are common to all kinds of straps in general and to harness and cart gear in particular.

Straps made to exact length with only one hole are cut long enough beyond the hole to go through the loop, and so give the work a neat finish. When the unused part of the strap varies considerably in length, the part run through the buckle being sometimes 6 in. long and sometimes 3 ft. long, a runner loop must be made to hold the point of the strap.

A runner is a loop which runs loosely along the strap to any required part. To make it, one end is laid on the other, overlapping it more or less according to the size of the loop, and the material is then stitched ; it must be made loose enough for two thicknesses of the strap to pass easily.

The width of the loops, except in the case of pipe or box loops (defined later) must always be in proportion with that of the strap ; the broader the strap, the broader is the loop. Taste and a due sense of proportion are necessary here as elsewhere. The loop must never be placed too near the buckle, particularly when the strap running through is stiff. Both ends of the loop should be placed so that they can be firmly stitched ; the first end is stitched easily, but the second requires more practice. The ends of the loop should be made to meet in the

centre of the strap, care being taken to catch it at the first stitch, for then it will not easily slip from its place. Two stitches on each side may suffice, but a very wide loop will need four or five on both sides of the ends. Slant the awl with every stitch, using the end of the awl to drive the loop a little out of the way.

It must not be taken for granted that a firm hold of the loop has been obtained until it is completely stitched; but make sure of the work at the first stitch, as otherwise it may be necessary to

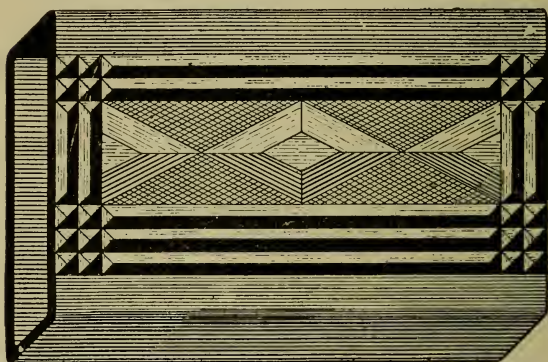


Fig. 67.—Box Creased Loop.

unstitch the work and do it again. Care must be taken also to ascertain that the loop is straight in its place at the first stitch, and that one side of the same end is not farther in than the other. A crooked loop spoils the appearance of the whole of the work.

Box loops (Figs. 67 to 70) or, as they are styled, pipe loops, are long loops like those on bridle cheeks, bearers of gig breechings, hame tugs, etc. To make them, measure the length and width of the loop required; for example, a bridle cheek  $\frac{3}{4}$  in. wide and 8 in. long will need a loop  $1\frac{3}{8}$  in. wide and  $7\frac{1}{4}$  in. long.

Before making the loop, crease a line along the place to be stitched, about  $\frac{1}{8}$  in. from the edge, and cut a groove along the line to about half the depth ; then open the groove well with the blunt point of a compass, passing it backwards and forwards. The stitching is done along this groove, which is finally closed.

The groove is necessary on account of the coarse stitches, about four to the inch, which are thus kept out of sight and prevented from being worn away by friction. Another method is to slit the leather about

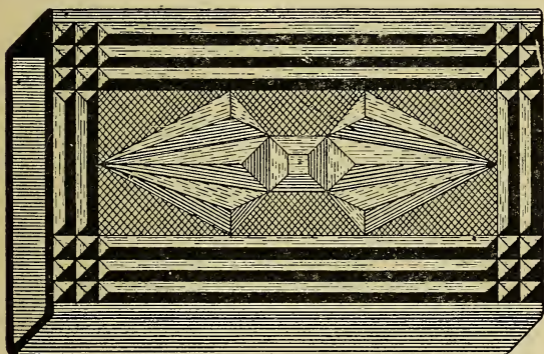


Fig. 68.—Box Creased Loops.

$\frac{3}{16}$  in. from the side ; then to raise it and stitch under it. When finished, apply a little paste or gum to hold it firm, and smooth it down over the stitches.

Mark a line on the loop at about half the width of the strap and run a writing pen along it to keep the mark visible ; the loop, being of brown leather, will retain the mark of the ink, whereas the compass mark alone would be obliterated by damping. This mark is essential as a guide in fixing the loop and stitching. Mark the inside of the loop first time and the outer side the second. Damp the loop well first. Stitch the first side with black wax three-cord

thread about  $\frac{1}{4}$  in. apart; this is an easy job, the difficult point being the blind-stitching. Put the loop between the winker and the cheek as far as

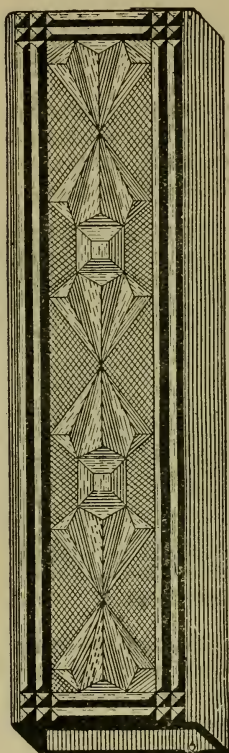


Fig. 69.

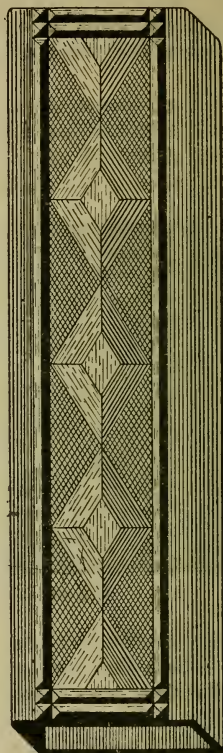


Fig. 70.

Figs. 69 and 70.—Box Creased Loops.

the mark and put a tack in each end and one in the centre.

The first stitches are simple enough, but when it becomes impossible to see and reach the hole the

awl must be put right through the loop to the other thread about  $\frac{1}{4}$  in. apart; this is an easy job, the side, the needle and thread being passed afterwards. Take the needles off both threads, and by means of a wire hook pull the inside thread out through the loop until it is 3 in. from the hole it entered. Now put the awl through the thread close to the loop, run the end of the other thread through for about 2 in., and pull it through the hole by the aid of the first thread to the side being stitched. Take out the end of the thread, put through and pull both extremities until tight, one in the groove and the other inside the loop. Repeat this operation with every stitch, but when about half-way through the loop, the thread inside must be run through to the other end, the work being continued from that end until finished.

Another method of making box loops, though it is not recommended, is as follows: Put an iron loop-stick inside and fasten the loop down by driving small tacks into the groove, this groove being then closed by rubbing the edges well. A third method consists in running the threads through with a bristle, or twisting the threads together and thus running them through.

## CHAPTER V.

## CART HARNESS.

THE make and pattern of cart gear are very varied in all parts of the kingdom, and there is often a local name for each particular style; but the only gear which can claim special favour is one that combines proper strength with minimum weight.

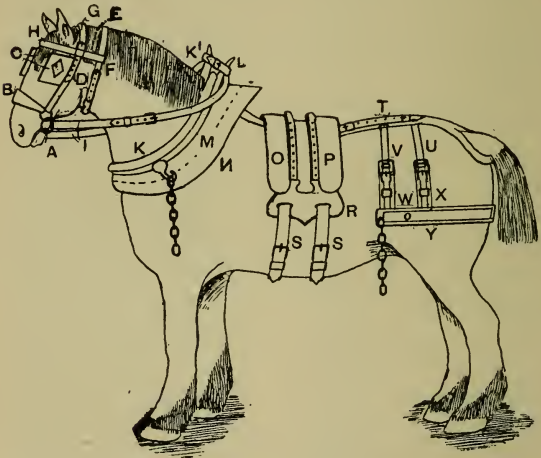


Fig. 71.—Horse in Cart Gear.

A typical shaft gear is shown by Fig. 71, in which A is the bit ring, B the noseband, C blinkers, D cheekpieces, E ear-pieces, F throatlash, G head-strap, H forehead band, I reins, K collar forewale, K' hame straps, L hame or joggles, M collar body and side-piece, N collar draught, O forecart saddle housing, P back housing, R cart saddle skirt, S girth and

girth straps, t crupper, u and v hip and loin straps, w and x fore and aft breeching tugs, and y breeching.

The ornaments used are brass buckles (Figs. 72 to

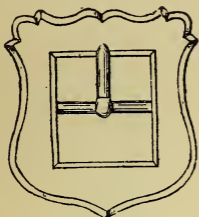


Fig. 72.

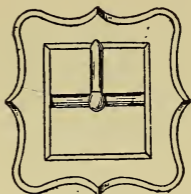


Fig. 73.

Figs. 72 and 73.—Scotch Brass Gear Buckles.

75) instead of tinned or japanned buckles, with brass face-pieces (Figs. 76 to 78) on the bridle to hang on the horse's forehead, brass bells for the bridle (Fig. 79), hame plates (Figs. 80 and 81) at the top of the collar between the two points of the hames or jambles, with a strap across from one hame point to the other to hold it in position, brass squares,

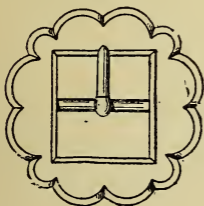


Fig. 74.

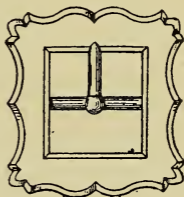


Fig. 75.

Figs. 74 and 75.—Scotch Brass Gear Buckles.

ovals (Fig. 82), octagons (Figs. 83 to 85), hearts (Fig. 86) on bridle winker or saddle housing corners, and brass beading instead of nails over the top of the housing where attached to the tree. When

making gears this must be remembered. Other details of cart ornaments are shown in Figs. 87 to 92.

Cart and leading gear made according to the following directions will be useful anywhere, and when this method has been learned any other style can be made.

The winkers c (Fig. 71) must be prepared first; blocked winkers with fancy pattern raised against the eye are little used nowadays. Plain winkers are just as safe for the eyes if well made. Special winker leather must be obtained either from a middling in

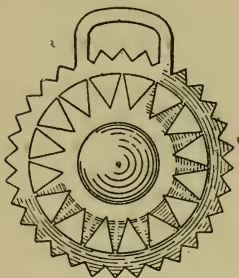


Fig. 76.

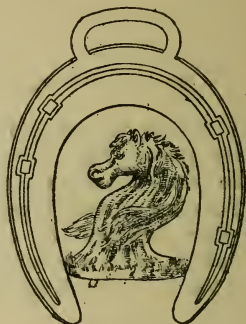


Fig. 77.

Figs. 76 and 77.—Brass Face-pieces.

stock, or, cut to pattern, from any currier or leather-seller.

Cut the pieces straight 7 in. by  $7\frac{1}{2}$  in., and mark three rows all round the long side and across one of the shorter sides with the race compass or racer, making the groove deep; edge them above and below with the edge tool and black the edges. After soaking them well in water, bend them along the centre of the longer width into something that is nearly, though not quite, a semicircle. Nail them down in any convenient way, with the raised part above, on a flat board and let them dry in this

shape ; drive in the nails near the edges only at the side that will be covered and stitched over with the cheek. They can be put to dry near a stove or fire.

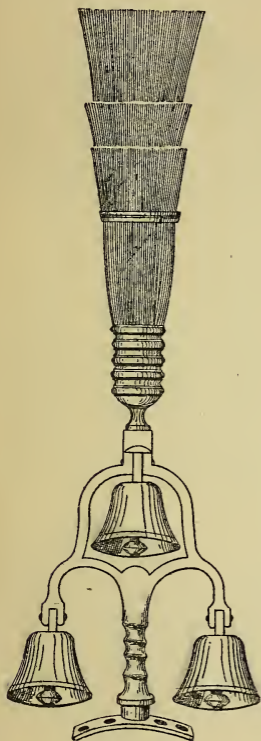


Fig. 79.



Fig. 78.



Fig. 80.



Fig. 81.

Fig. 78.—Brass Face-piece. Fig. 79.—Bells and Brush.  
Figs. 80 and 81.—Brass Hame Plates.

Then run a big hot beveller round the edges and along the lines made until the groove looks deep and polished. Having two  $\frac{3}{4}$ -in. roller tinned buckles, or

brass Scotch buckles, cut two chapes to the same width. Chapes are pieces to hold on the buckles ; the name is also applied to the part going round buckles on any length of strap. The chapes are



Fig. 82.

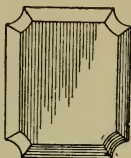


Fig. 83.



Fig. 84.



Fig. 85.

Fig. 82.—Brass Oval. Figs. 83 to 85.—Brass Octagons.

made  $3\frac{1}{2}$  in. long and turned down 2 in. from one end ; make the short end very thin and the other end slightly so, then point the piece. Cut a buckle hole at the bend, edge, crease, and prick for stitching ; then put the chapes in the buckles and make the tops of these last flush with edge and front of winkers, working as follows:—

Tack the chape down in its place in the front corner where the creasing on the edges meets, and



Fig. 86.

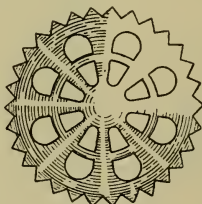


Fig. 87.

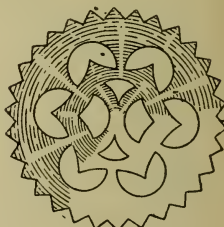


Fig. 88.

Fig. 86.—Brass Heart. Figs. 87 and 88.—Brass Stars.

stitch. With tinned buckles put on a loop ; Scotch buckles, as Figs. 72 to 75, do not need any ; place the other chape and buckle on the corner of the other winker and stitch likewise, taking care to put

it on the reverse corner to the other to make the winkers pair.

Now cut the cheeks D, or the pieces that run down



Fig. 89.



Fig. 90.



Fig. 91.

Figs. 89 and 90.—Brass Hame Knobs. Fig. 91.—Brass Swing.

the side of the head, making them 2 ft. 2 in. by  $1\frac{1}{4}$  in. ; turn them down so as to make both ends

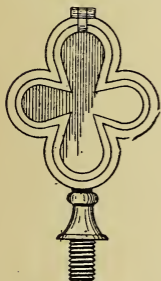


Fig. 92.



Fig. 93.



Fig. 94.

Fig. 92.—Brass Swing. Fig. 93.—Ear-piece. Fig. 94.—Corner-piece.

meet underneath in the centre, and give the bends in each end a slight tap with the hammer. It is

better to draw in the underpart a little so as to have the top somewhat longer, because as there is a bend in the winker outwards the lower side should be a little shorter. Cut a hole for the buckle in one end and another in the centre of the bend, which is also the centre of the strap, at the other end ; from this hole cut straight out to each side and shave the edges of the cut. Edge the cheek on the outside only and race it along the top part with the race compass ; the second race must be made close to the other, care being taken not to run them into one another. Make another line a little more than  $\frac{1}{8}$  in. from the last, blacken the edges and lines with black dye, and rub them with a rag ; then prick the two inner rows with the pricker, eight per inch, put the buckle in its place and the bit ring A in the other end, and stitch both ends of the cheek together. There are two bit rings on each side, fastened together by a small link ; one ring, that placed in the cheek, is larger than the other. The smaller ring must be kept for the bit after the completion of the bridle. Both cheeks are made in the same way, but the slit from the centre hole in the bend must be reversed, otherwise the cheeks will not pair.

The winkers c and cheeks d (Fig. 71) being ready, cut the nose-band B about 2 ft. long and 2 in. wide ; turn in both ends equally, leaving about 1 ft. 4 in. for the noseband ; shave the ends rather thin, and make a punch-hole in the centre of the bend, then slit it out straight from both holes on the same side, and shave the sides of the slit.

Edge both sides of the nose-band where it is not double, and make two rows along it with the race compass, deepening and polishing them with the hot beveller, after which prick the double row on both sides from the bend to the lined part.

The nose-band is now ready for adjustment at the proper time. The forehead band H (Fig. 71), or

front, must be cut about 2 ft. 3 in. long and  $1\frac{1}{2}$  in. wide. Edge, crease, black, and rub it and pass a hot beveller over the grooves. Cut the ear-pieces E (see also Fig. 93)  $1\frac{1}{2}$  in. wide and 9 in. long, and double and flatten the bend, shaving one end well. Take a piece of any strap  $1\frac{1}{4}$  in. wide, and put it in the bend, close up; mark how far the inner side runs in the ear-piece, the  $1\frac{1}{4}$ -in. strap being allowed to run smooth in the opening between the line and the bend. Mark two rows of pricking, eight per inch, on each side from the cross-mark to the point or end, having previously made a double row of creasing all along. Stitch from the cross line to the point with three-cord thread; stitch the cross line coarse, about two stitches for one of the other stitches. Rub the edges, making them even by cutting if necessary, then black and rub. Place the forehead band H in position, and stitch it end to end with the ear-pieces, and cut a small V-nick in the joint of each end on the same side.

The object of the nick is to provide space for the small projection in the tongue of the buckle when put into position. Some harness-makers cut the end of the ear-pieces, before joining them to the forehead, in a slightly slanting way in such a manner that the end with the opening will turn up a little when in place, but this is not essential. Moreover, if the forehead band is to be covered with any kind of fancy cloth or leather, this covering had better be done before the ear-pieces are stitched, because the work will be much easier than when the bridle is completed. Cut the material, red American cloth, leather, etc., double the width of the forehead, and allow  $\frac{1}{2}$  in. more to go round the edges; finally, herring-bone-stitch underneath along the centre, and stitch on the ear-pieces.

Corner-pieces (Fig. 94) are now required to support the nose-band and to join it and the cheek well together when complete. They are in one single

piece near the bit ring corner, descending from cheek to nose-band. To make the chin strap, cut it  $1\frac{1}{2}$  in. wide, one piece being made 6 in. long, leaving 2 in. of the original width, and then narrowing the rest to  $\frac{3}{4}$  in. with a rounded point. The other part is made 12 in. long, and 2 in. of the original width is preserved, the rest being narrowed to  $\frac{3}{4}$  in. ; then turn down a chape and make a hole for the buckle in the narrow end, after which edge, crease, and black both, then adjust buckle and loop.

To put the bridle together ready for stitching, work as follows: With a ring at one end and a buckle at the other, place the forehead band between the cheeks in such a way that the centre where the forehead band and ear-pieces join may be right under the centre of the buckle with the nick against the tongue. Drive a tack on the inner side, and put the nose-band in the same ring as the cheek at the other end, with the slits made in the bends upwards ; fix the corner-pieces one part in the cheek and the other in the nose-band, sufficiently low to catch when stitching the nose-band. The corner-pieces must, of course, be placed between the two leathers, both in the cheeks and nose-band: the inner side of the corner-piece must follow the ring in the cheek like a half-circle.

The outer part is supposed to have been previously edged and creased. The point of the slits in the nose-band comes underneath the slits in the cheeks on both sides in such a way that the edges in the cheeks may cover and neatly overlap the edges of the slit in the nose-band and catch them during work of stitching the cheek. Both winkers are now adjusted with buckles in the front corners, turned upwards to meet each other ; place the winkers close to the ear-pieces and forehead, making the outside flush with the outer edge of the cheek. Tack down the winkers, keeping the bend in shape as set after drying ; thus there is an opening between the two

sides of the cheek from the end of the corner-piece to the bottom of the winker.

Cut a piece of leather as near as possible of the same thickness as the winkers and of the same width as the cheeks. Place it between the two sides of the cheek to fill the hollow, and so have a firm cheek all along; tack the piece down and see that it fits tight; there must be no looseness where it joins the winker and corner-piece.

The chin strap is now adjusted, the wide end of the short piece being placed inside the cheek under the centre filling for a distance of about  $\frac{3}{4}$  in. and about  $1\frac{1}{2}$  in. from the bottom ring. This is the right-hand side, taking a front view of the bridle. The other piece, with buckle, goes on the other side, and both are tacked down. When two small loops are to be placed on each side near the buckle at the top of the cheek they should be tacked down so that they may be stitched in with the cheek; but for a long loop, adjust beforehand on the cheek, by stitching the ends loosely together. Nail the first side of the long loop and clinch the nails underneath over a loop-stick, leaving this inside while nailing the other side in the same manner, partly running over the ear-piece E (Fig. 71) and forehead band H and partly over the winker.

Stitching may be begun on the near side at the ring, and continued up to the loop on the outside; then begin at the loop on the outside of the other cheek and stitch down to the ring. The outer row on the inner side of the first cheek and of the second cheek is now stitched. When stitching opposite the winkers on the inner line two stitches may be made instead of one by slipping a stitch between each; fine stitching is apt to cut the winkers, and they often fall off before being worn out; consequently slipping a stitch is a good method. A row must now be stitched on each side of the nose-piece in each end, then the inner rows of the cheek, and finally

the inner rows of the nose-band. Level the edges of the cheeks and nose-band, scrape them, and black the edges ; then rub them with tallow and bone.

Having creased and finished the loops, make two basil pads as long as the distance from the buckle to the bottom of the winkers. For a cheek of  $1\frac{1}{4}$  in., cut the pads 1 in. wider than twice the width ; fold them lengthwise so that the edges will meet in the centre, and stitch the ends together with the basil inside out. Now, after turning them inside out, stitch the edges together like the ends with pointed needle, thimble, and white linen thread. Run the stitches from both ends and leave an opening about 1 in. long in the middle, through which ram in the flock stuffing, but not too hard. Having stitched the opening, place this side against the cheek of the bridle under the winker, and as far as the buckle ; choose three nails having large heads, run small tufts of flock to the heads of the nails, and fasten the pads down firmly to the cheek by driving a nail in each end and one in the centre, taking care that the points do not appear on the other side ; trim the flock on the nails with the scissors.

The winker straps are made as follows : Cut a strap 24 in. long and  $1\frac{1}{2}$  in. wide, then slit it exactly in the centre for 13 in., making a punch hole at the end of the slit ; shape the points of each slit to go through the buckles on each winker, and make a cross line  $1\frac{1}{2}$  in. from the end of the slit, marking it deeply. At a distance of  $1\frac{1}{2}$  in. from this line make a second line, and a third  $1\frac{5}{8}$  in., making them all deep ; turn down the strap so that the centre of the bend will be exactly at the last mark. Knock the bend flat if the point runs beyond the end of the slit after turning down ; cut some off and shave it down ; edge it on both sides except where the parts overlap. Crease all along the edges, and make one or two rows with the screw-race ; then black, rub, and finish the creases. Leave an opening from the bend

to the next cross line, then put a piece of leather to fill the space between the cross line and the next to it and wide enough to be stitched through in working across; then leave the space between the next two lines open, and stitch down the point of the bend from the end to the cross line. Stitch along the pricked part and along the cross lines, the stitches on the latter being twice as coarse as the straight lines.

There should now be two openings, one at the end and the other beyond the next stitched part; that at the end is for the throat lash *F* (Fig. 71), and the other for the head strap *G*. Having rubbed the edges and finished, cut the head strap 1 ft. 10 in. long and  $1\frac{1}{4}$  in. wide; narrow the ends for the passage of the buckle, crease, black, and finish. Now cut the throat lash 3 ft. 8 in. long and  $1\frac{1}{4}$  in. wide; turn in 2 in. for the buckle at the best end and narrow the point to enter the buckle at the other end; crease, black, finish, stitch on the buckle and loop, and then finish the loop.

A rein is now cut 5 ft. long and  $1\frac{1}{4}$  in. wide for the off side, and another 2 ft. 4 in. long for the near side. Turn down the chape for the buckle in the weakest end of the short rein, and 3 in. at the best end of each to fasten to the ring at the bit; then edge crease, finish, and stitch in the buckle and loop, also making a running loop on the short rein. Now mark four rows of stitching on the double part about to be stitched to the rings; stitch the shortest part of the rein with the buckle to the ring hanging by a link from the cheek ring on the right hand when looking at the front of the bridle, then stitch the long rein to the ring on the other side. Make three punch holes on each side of the head strap, equidistant from the point and from each other, and then six holes in the throat lash, three in the slits of each winker strap, and nine in the long rein.

The bridle being ready for adjusting, place the

head strap up to its centre in the opening next to the slit in the winker strap ; then fasten each end of the head strap to the cheek buckles through the second holes. Now place the throat lash in the opening in the ear-piece on the off side, running it through the outer opening in the winker strap, down the opening in the other ear-piece, and then through the buckle at the other end.

Buckle the winker strap slits to the winker buckles, pass them through the loop, and buckle the rein in the sixth hole ; this completes the bridle. If it is to be polished, coated with jet, or ornamented, this must be done before putting the parts together.

Cut out all parts according to the dimensions given before beginning to stitch ; this is more workmanlike than cutting the parts as the work proceeds.

## CHAPTER VI.

## CART COLLARS.

IN making a cart collar (see Fig. 95) the first part to take in hand is the forewale A; the material for this must always be cut 8 in. longer than double the length of the collar when finished, to allow for shrinkage. Supposing the collar is to be 20 in., the leather must be cut 48 in. long. The leather can be cut from the bellies of gear hides, which come in handy when proper hide is not available. Cut it  $7\frac{1}{2}$  in. wide and make the length to meet requirements, and then damp it thoroughly. Stretch it on

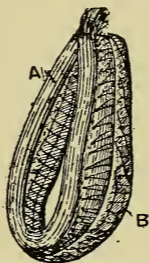


Fig. 95.—Cart Collar without Side-piece.

a flat board by holding one edge with the hand and pulling the other edge with the pincers. Fold it over  $2\frac{3}{4}$  in. all along; adjust the compass by rule to  $2\frac{1}{4}$  in., and mark from the turned side, so that there will be  $\frac{1}{4}$  in. of leather outside the mark on which to stitch the lining. On the opposite side there will be about 2 in. to draw in the body B and stitch the side-pieces. Tack along the mark here and there to keep it in its place.

Make a ten-strand thread, waxing it before and after twisting. This thread must be long enough to

stitch all the length, and at least twice as long as ordinary thread. Use strong needles, making about three stitches to the inch ; always leave the stitches slack, merely drawing them home, especially for about a foot on each side of the centre. Thus the forewale will bend easier in working round, and the stitches will tighten enough in stuffing. If the leather has an uneven grain, close here and open there, a piece of calico slack may be put inside the forewale A ; take care that both sides of it are caught in stitching. This will help to keep it straight even when being stuffed.

The forewale is now ready for stuffing. Having a bundle of rye straw at hand, pull a few handfuls across the knee until the straw is straight ; cut the ears off, and then cut the handful of straw in half, and again divide it with the collar knife until about 9 in. long. Place it neatly in a heap near the working-seat on the right-hand side, with the collar rod and mallet lying close by ; there must also be a thick, solid block of wood placed on the firm ground in front of the worker's seat.

The collar-maker must now sit down and mark the centre of the leather with a nick or stitch. The forewale is now placed on the block, and the left foot laid on it, about  $2\frac{1}{2}$  in. from the centre, the folded part of the forewale being furthest. Put the other end on the right knee, and, holding the collar rod in the left hand point upwards with the head against the knee, take about half a dozen cut straws, and give them a half twist with both hands. Place the centre of the wisp in the nick of the collar rod and hold it firm with the right hand, the forewale being handled with the left. Put the straw in the forewale and press it down to where the foot is on the block,  $2\frac{1}{2}$  in. from the centre ; beat the wisp well on the block with the mallet, leather as well, and then put another wisp in from the other end, taking care, when putting in the wisps, that they do not catch

those already inside and drive them back ; to avoid this, beat well after each wisp has been put in, and when the iron reaches them raise the point a little. Continue to work in this way, putting in wisps alternately at each end until the forewale is as hard as it can be made. When the straw seems firm enough not to move, the wisps can be knocked in instead of being pushed by hand. See that they go into the centre of the straw. Push the straw and rod down the centre as far as possible ; turn the forewale and the rod with the point upwards, knocking the wisp in firmly against the collar block in front.

Repeat the process from the other side, and so on until all is as hard as a piece of wood. To shape and round the collar it must be continually turned round the knee, turning one side to the right and the other to the left hand. This operation is repeated after every one or two wisps are put inside ; take care that the forewale does not get straight. When turned enough, three or four wisps may be put into each side before changing ; but both sides must be shaped alike.

When approaching the top, shape it inwards a little in the same way as it was turned ; fill with straw until the top is quite firm, and then place it flat on the block, beating it well into shape with the round mallet, and holding it down with both knees at one end while shaping the other. Now damp it, and turn it backwards a little at the top on both sides ; stitch both points firmly together with waxed twine and collar needle and hand iron, cutting a little off when necessary to bring it to the right length.

To make a pipe collar, follow all the above directions and proceed as below. Obtain a piece of iron 9 in. long,  $\frac{1}{2}$  in. in diameter, and having a sharp point ; in the middle it must be shaped half-round, with the points turning a little outwards and upwards. Put straw around it, tying it as tightly as

possible to within 2 in. from each point, and let the straw at each end be of different lengths, a few inches longer than the points of the iron, so that it will splice well when stuffing is commenced. Add straw, and tie again until the straw around the iron is the right size, then place it in the centre of the forewale, and stitch as tightly as possible, pulling the stitches well ; make sure that it fills the forewale well, but having passed this part, leave the stitches slack. Now stitch from end to end, and stuff from each end as in the other case, remembering to splice them well where the iron ends ; the sharp point will not be much of a hindrance. Finish as with the other collar.

In making the body of the collar, cut the lining to Fig. 96, and in any required size ; 14 in. is about the average at the draught when the strain of pulling is on the collar. Cut a leather throat-piece about 2 in. wide at the base, and widening out to  $3\frac{1}{2}$  in. in a sweep to the top. Stitch the narrowest end of the lining, which is about  $4\frac{1}{2}$  in. deep, to the sweep of the throat-piece, turning in a little of the linen or woollen check to make the part under the stitches strong.

The narrowest part of the centre of the throat-piece must now be tacked to the exact centre of the collar by the stitches, putting the edge even with the rim of leather running inside from the stitches.

Add another tack without pulling at the lining, but leaving it rather slack from the centre, just at the part where the forewale begins to run straight upwards. Another tack is now placed within 5 in. from the top on both sides, and the lining pulled tightly to there from the bottom, the edges being turned in all round.

Basil is employed for part of the lining in some localities ; about 6 in. is measured from the top of the collar. A pattern of the lining must be cut out of brown paper, and then the basil can easily be

made to fit the shape of the linen lining; the basil must be whipped in with white linen thread and the linen turned in a little under the stitch, being rubbed flat afterwards. The lining being ready, make a four-cord thread of black-wax, cut it in two, and thread a harness needle with half. Having a suitable awl, whip the lining in all round through the leather rim above the stitches inside the fore-wale; the stitches of course must be inside, and should be well rubbed. Everything is now ready for making the body. Wax some strong twine or make a long beeswax thread, with four or five strands,  $3\frac{1}{2}$  yds. long, and have another about  $1\frac{1}{2}$  yd. long with six or seven strands.

Now a strong old strap, 1 ft. long, with a buckle is wanted; this is called the throat strap. The hand-iron, a medium-sized collar needle, seat-awl,



Fig. 96.—Cart Collar Lining.

scissors, and collar knife being placed near at hand, get a bundle of rye or wheat straw, preferably rye, and place it straight together by the side of the stool, with a sheet of drummed flock or basket of carded flock all within reach. As during work the legs are placed inside the collar, making it awkward for the operator to move, it is well to have handy a flat-headed mallet besides the collar mallet. Thread the collar needle with the shortest thread and hang it close by, and having pulled a big handful of straw from the bundle, sit down and put the right leg through the collar lining, the throat being placed upwards.

Place the middle of the handful of straw exactly

in the centre of the throat-piece, between it and the forewale ; then take the needle and thread it, the handiron being in the right hand. Make a stitch from the centre of the throat over the straw to the big margin of leather on the other side ; make another stitch at the same place to keep the throat in the centre, and more stitches, about  $1\frac{1}{2}$  in. apart, for about 6 in. up one side from the middle towards the left. Fasten the thread and cut it, turn the collar with the other side facing you, and stitch it again on this side exactly like the first, taking great care to make both sides similar in shape and size.

Take the stuffing-stick and fix a wisp of straw on the point, beating it along to the centre of the straw and a little beyond the centre of the throat. Place a similar one on the opposite side, and so continue until the bottom part is firm and hard. Now lay it on the block, with the lining on the top, and pull the lining outwards as much as possible. Hold it by the knees, one on each side, and beat the throat outwards as far as possible with the round collar mallet. Put the throat strap round it and the forewale, pulling it as tightly as possible to keep it in position while making the other part. Now take a wisp of straw, large enough to fill the body of the collar pretty well, cut it square at one end, so as to get almost the full bulk at the section, and see that it is long enough to go the full length of the collar body.

Wrap a piece of hemp five or six times round the part just cut, making it firm for about 6 in. along, and somewhat pointed. Run the long thread through the needle, and put both knees through the collar with the lining towards you. Open the lining flat as it lies on the knee and raise the straw issuing from the throat so as not to be in the way ; then cut a piece of drummed flock to the same size as the lining, to come within an inch or so of the edge. Take care to place it level in all parts, reaching well down towards the throat and forewale. Cut another

handful of straw and put it over the flock opposite the draught and as near as possible to the forewale.

Open the straw running from the throat in the centre, and put the long tied wisp inside, ramming it as near as possible to the throat; pull the lining over the straw from the top to the bottom, and then pass the seat-awl through the lining and leather to fasten the top. Turn the collar the other way about, put both legs in again, and begin to draw in the lining where the bottom stitching left off.

Now lace it from bottom to top, running the needle from lining to leather and leather to lining till finished. Draw the stitches as tightly as possible, pulling each to tighten the other, as in lacing a boot. So far, the collar is neither hard enough nor shapely enough; the straw must therefore be beaten down between the lacing. To do this, the mallet must be grasped round the handle close to the head, and the straw struck as hard as possible with the handle.

Having improved the shape of the collar, begin to tighten the lacing again from end to end, keeping the desired shape constantly in mind. If the collar is not firm enough, begin work at the bottom, ramming down some wisps towards the throat from between the stitches, and continue this until the draught is reached, shaping as well as stuffing. It may be hardened, from the draught up to the top, by driving some wisps from the extreme top, and shaped by tightening or slackening the lacing, as the work demands.

Great attention must be given to shaping, for a well-shaped body is very important from the point of view of both utility and appearance; it should be graceful and rounded at the bottom and somewhat flat at the draught, gradually growing narrow towards the top. At the extreme tip, however, the collar should be rather full, with extra flock to ease the neck. Work in the same manner with the other

side, using as nearly as possible the same amount of flock and straw ; take care to obtain the same shape and size.

If any lumps can be felt in the flock, loosen and level it with the seat-awl by stuffing it off or on as required ; beat it slightly all round to give it a smooth appearance. Cut the straw at the top, turning the lining down out of the way ; beginning close to the forewale, cut it slanting upwards a little towards the back. Make two or three long stitches in each side through the lining on both sides and the straw to pull the linings together. Then stitch together the two sides, drawing the lining over the outer side ; run the stitches through from side to side and cut the spare lining at the top ; this completes the work. Trim the points of the forewale previously stitched, and cut them into a neat point, which should be neither long nor sharp.

Having cut a piece of soft leather, form it into a cap reaching low enough to cover the stitches that join the point on each side ; stitch the front with a welt between the edges long enough to reach the back under the forewale, so that a stitch can be put through it there when stitching the cap. This last must be long enough to come over the point of the body behind ; damp the cap and put it in its place. Take a lace and the collar needle, draw it down tightly into the hollow between the body and the forewale, then stitch through it, burying the welt underneath to fasten the cap in front by a stitch.

The other part must be stitched with a lace all round over the top of the body ; make the point of the forewale very prominent to hold the hame strap.

Two  $1\frac{1}{2}$ -in. straps, 18 in. long, must now be cut ; race the edges and blacken them, point them for the buckle, and punch four holes in each, and another hole in each corner at the opposite end and one in the centre  $2\frac{1}{2}$  in. from the end. The four holes in

the forepart are to fasten the buckles to the crupper or cart-saddle and the others to stitch to the collar. Place one on each side of the collar down to the forewale 5 in. from the top. Fasten them with lace by stitching through the hollow between the forewale and collar body, putting two stitches through and through to the other side; then send the collar needle in the direction of the other hole in the centre of the strap, and make one stitch from each side of the strap through this hole; fasten the lace well and cut it.

Pieces of leather of the shape shown by Fig. 97 are now required to cover the side of the body. The pattern can be cut out of brown paper according to the made body and kept for other work. Cut the

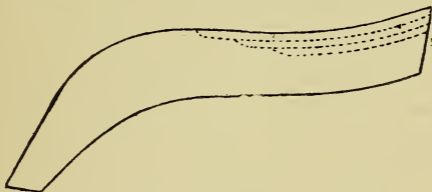


Fig. 97.—Cart Collar Side-piece.

paper close to the rim all round to cover the body full in all parts outside, but a little wider and pointed at the top to keep rain-water off and give a good appearance. Cut one side only at a time, and, as the two sides join in the centre at the top and bottom, cut the top slanting downwards towards the forewale to the same shape as the body, and line the top for about 1 ft. downwards on each side with firm leather; shave it on the inner side and bottom.

The pieces need not be so wide as the side-piece; half its width or a little more will do. Make three rows of stitching, and join them together at the lower part along the lined part; the distance between the rows should be about 1 in., with nine

stitches per inch. Rub the side-pieces and blacken them; crease two rows with a screw-crease all round the outer side not stitched. When cutting, take care to have the best part under draught. Join the two sides together at the top with stitch after stitch from one to the other, thus drawing them close end to end.

Crease and prick a  $1\frac{1}{4}$ -in. piece of leather, cutting it to the same length as the joint, and thinning it towards the collar end; the other outer end must be shaped to the point of the joint. Now tack the piece and stitch, keeping it quite over the centre of the joint, and making the stitches exactly at the same distance on both sides; it is well to put a bit of thin lining underneath the stitches. Damp the side-pieces well in water, and have a long lace ready to run the side-piece in; damp and grease it, and have it long enough to go all round the collar if possible, with sufficient to spare for fastening.

Take out the side-pieces, beat the water from the leather, and fasten the pieces to the centre on top with a big strong awl or seat-awl. Pull them together as tightly as possible from top to bottom; let them overlap about 3 in. at the bottom, shave the leather down a little here, and fix the pieces in place with the awl. Then see that they are in the right position, not too near nor too far from the forewale; put an awl on each side near the draught to keep them in position there.

Begin lacing them in at the throat-piece, making the stitches 2 in. or  $2\frac{1}{2}$  in. apart, at about the same distance from the edge all round; be sure to catch the lining underneath with each stitch. Then take another long lace and pull it in at the throat; draw it close to the forewale all round till the point of commencement is reached, running a stitch over the edge of the side-piece, and catching the leather everywhere by the forewale; the stitches should be about  $1\frac{1}{2}$  in. apart.

Some harness makers run a piece of leather about 13 in. under the draught, fasten it with a few stitches to the collar body in the lower part, and spot with lace to the side-piece all round the top part; coarse flock, or anything which will keep the chains from the horse's shoulder when pulling, being employed for stuffing; but this will not be necessary if the body of the collar is well made. Others make the side-piece without lining, using instead a round piece of leather with canes round the rim, covering them with leather stitched on both sides to protect the shoulders and collar from wet. They are stitched with lace to the collar.

Experience, however, has demonstrated that neither the horse nor the collar is any the worse without such a device. In other localities the housing and side-piece are cut in one piece—a poor imitation of a Scotch collar—and stiffened all round with cane; this involves a great waste of leather, and is unnecessary.

## CHAPTER VII.

## CART SADDLES, REINS, ETC.

THE saddle is another important part of cart harness. To make a saddle for a horse about  $15\frac{1}{2}$  hands high will need a tree (Fig. 98) measuring 14 in. across the board right through the centre. It may have an iron plate for the back chain covering entirely the top of the tree, or only partially covering it, but with plates at the point and one in the centre of the groove. The plate can be removed from the first kind of tree when making the saddle, but the partial plates are permanently riveted with an iron pin. If the board across the tree is very long it may be sawn off at each end, but never at one end only. Saw off the same length at each end; a 1-ft. board is always long enough.

The tree can be obtained also in the pattern required for nailing housings (leather covers) on the bridge of the tree at the top, or with a projection running along both sides lower down for nailing. If the housings are nailed at the side, the width need not be so great as when nailed on the top; the part of the tree above must be covered with thin leather, nailed under the housing at the lower edge, damped and rubbed down close to the tree and nailed at the very top.

The panel (Fig. 99) can be made when the tree is ready. From the middle of each side cut the panel-back about  $\frac{1}{2}$  in. longer than the boards and 2 in. wider than the central width of the board. Leave the space between the middle lines of stitches about 2 in. wider in front than at the back to prevent the shoulder-bone of the horse being caught when carrying a weight. Cut both sides alike, reversing the pattern to pair them. Then whip them together

along the centre and shorten the panel-back in front by cutting from the point, slanting inwards and upwards in the fore part.

When the sides are joined, rub the stitches flat and put pieces of leather, about 3 in. square, at each end at the positions of the boards when the panel is in position ; mark the back of the panel on the spot to which the boards reach and then adjust the pieces of leather, stitching them across, the marks being nailed as nearly as possible in the centre of the board. These pieces are for nailing the panel in place when completed.

The panel must now be laid flat on the flannel check or linen lining, which is cut about  $\frac{1}{2}$  in. larger than the back. As the panel is wider in front, the lining must be slit in the centre of the front as far



Fig. 98.—Cart Saddle Tree.

as the point where the panel begins to widen ; then cut a piece of the same material of the necessary width in front and narrowing towards the back. Whip this piece to the lining, turning down the edges of both while stitching. The extra  $\frac{1}{2}$  in. beyond the size of the back is now turned in, and a coarse stitch run all round.

The leather basil facing for the panel is now cut about  $2\frac{3}{4}$  in. wide, then whipped in all round the lining, being joined and stitched in the centre of each side. Rub the stitches flat, and cut the lining down round the back to about 2 in. wide, from the centre on each side. Then, when stuffed, the panel will be somewhat thicker in the front than at the back, and will not sink down and press on the shoulder-bones under a load. Now cut about  $1\frac{1}{4}$  in.

from the front part of the facing opposite the widening piece stitched to the lining ; cut it about  $4\frac{1}{2}$  in. long, gradually slanting it out towards the ends, and cut about 2 in. at the back in a similar style. Tack the facing round the back, centre to centre, and both inside out ; run it with coarse stitches, about three to the inch, keeping the edges together ; it can be either spotted or stitched double. Now well damp the back of the panel and the basil facing with sponge and water.

With scissors cut an opening in the lining exactly in the centre of the panel and just large enough to allow it to be turned inside out ; the cut must run along the panel, not across. This opening can be utilised for stuffing, but if it is necessary to make the cut longer than is required for this, let the opening be made a little shorter at each end so that the slit will be in the centre of the length. Put a line on each side of the stitches in the joining of the back, about  $1\frac{1}{2}$  in. on each side at the back, and then gradually widen from halfway to the front until it is about  $2\frac{1}{4}$  in. on each side of the stitches. Tack the lining underneath, making it tight and flat between the two lines and keep the slit in the centre, so as to have the lining distributed equally on both sides of the centre of the joining in the back.

Now take a wisp of straw, about 9 in. long, and wrap it round with hemp, making it firm and slightly thicker than a finger ; tie the centre of the wisp for about 5 in. and place its centre against that of the panel in the gullet at the front, and draw the facing tight for the distance between the two lines just made. Stitch it from above tightly round the wisp with a spot stitch to keep the gullet open and from the shoulder.

The lining must now be spot-stitched on the back along the two lines which have been marked, the needle being passed up and down through both. Leave an opening of the same length as the slit, and

carry the thread on the leather side from end to end of the slit so that the panel can be stuffed through.

To stuff the panel, place it on the bench in front, with the lining uppermost. Drive a stout clout nail with a head into each corner, and one into each end of the stitches in the side opposite the outer corners, the other side of the panel being allowed to hang over the bench, and the slit in the lining running along the edge of the bench. Having a heap of straw cut to the same length as the panel close by, and grasping the stuffing stick in the right hand, lay a wisp across the front and push it to its position with the stick. Lay another across the back, and work it through the hole with the fingers; then use the stick to drive it against the facing inside.

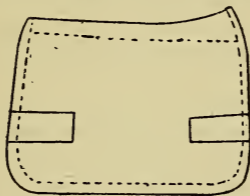


Fig. 99.—Cart Saddle Panel.

A third wisp must now be placed in the side farthest from the operator, and worked into place with the right hand and stick, the left hand being employed to keep the straw in position. Wisp after wisp can now be added along the front until the side is filled, but no more straw is put in the ends after the first wisp.

Beat the panel level and flat with the collar mallet, and run a piece of leather of the same width as the opening and about 9 in. long inside the slit for about half the length between the straw and the lining; this will clear the opening for the flock. Have a hamper full of carded flock, and put a thick, even layer over the straw, and press it down with a

stick or seat iron to the edges and corners, making it as smooth as possible ; then beat it again with the mallet, and use a seat awl to level the surface, feeling for lumps with the left hand. Work in the same way on the other side to complete the panel.

A dock to fasten the crupper to the saddle is placed across from board to board at the back. Two  $1\frac{3}{4}$ -in. tinned rings are needed, and the leather must be cut  $1\frac{1}{2}$  in. wide, and doubled to reach on each side as far as half the width of the board. It is better to make the dock in four thicknesses, running double through the rings. Insert these, one at each end, and drive a clout nail through each extremity and clinch it on a piece of iron ; put one or two nails in the centre, the points being shaved to make a good joint in the leather. Spot it with white lace, or stitch it coarse with strong thread, a row on each side. Trim the edges, and black and rub it with tallow.

Take two fine-pointed staples, and, with the dock in its place, mark the position with the points of the staples. Make holes for these with a gimlet half-way between the tree and the end of the board. Run the staples through the ring and knock them down in the holes until about  $\frac{3}{4}$  in. shows on the other side ; turn the points and knock them against the iron level with the board, turning in the tips a little to enter the board. The dock must be slack, with at least the same sweep from board to board as there is in the tree. Some harness makers nail to the centre of the tree a 2-in. strap, about 10 in. long, for fastening the crupper. This device can be adopted instead of the dock, and a buckle put on the crupper ; with a dock the crupper goes round it.

The flaps to protect the horse's side from the back trace reach from end to end of the boards on each side of the saddle. Cut them 9 in. deep more or less, according to needs, making them  $\frac{1}{2}$  in. longer at each end at the top than the boards. Swell them

out at the sides from the top and round the corners at the bottom, and cut a fancy point in the centre of the lower side.

Now hold them against the board with the same length exactly over each end, and mark the width of the tree on both sides on the flaps. At the marks cut a slit about  $\frac{3}{4}$  in. deep towards the near edge, and turn the leather inwards between the cuts in the centre. Knock it down between the slits, and cut a hole to admit the  $1\frac{1}{2}$ -in. girth or strap at about the middle of the flap on each side just opposite the junction of the boards and the tree ; as there will be two girths, a strap will run from each end of the board. Edge the flaps and holes all round on both sides, and make two or three rows round them with the race compass ; finish them with a hot iron after having blacked the edges. Reverse the cuts in cutting the flap to catch at the top on the boards, as these may not be the same length, back and front, over the trees, and there may be a difference in the positions of the holes for the girth.

The girths and straps must be made from good leather, the fore girth being 4 ft. 10 in. and the hind 5 ft. 2 in. long, an allowance of 2 in. being made to turn down for the chape. The fore strap must be 1 ft. 6 in. long and the hind 1 ft. 8 in. ; the width of girth and straps is  $1\frac{1}{4}$  in. to  $1\frac{3}{4}$  in. Edge the girths along both sides, and turn down the chapes and shape the points of the straps. Leave the best end of each girth and strap for nailing to the tree ; put two rows along the edge with a race compass and bevel with a hot iron. Stitch the buckles and make the loops, adding two running loops ; finish the loops with a loop-stick, and then crease them. Black the edges before using a hot beveller and cut four or five holes in the straps.

Now take the flaps and place the slit in the centre opposite the tree, and turn down the part below, thus having about an inch of leather on the board

under the slit. Drive a saddler's tack in each end of the board ; do this gently to avoid splitting. Put the shorter strap in front and the longer behind into the flap hole from above so as to bring the square end out at the top between the flap and the board. Adjust both in the same manner, and put four or five nails along the edge of the flap and board, taking care to drive two of them through the straps and flap ; finally put another nail in the centre of the strap above the edge of the flap. Add the girths on the other side in the same way, and see that the straps are on the near side and the girths on the off, and that the longer of each set is behind.

It is not difficult to determine which is the front of the tree because in this part the boards rise a little and converge towards each other. Sometimes, instead of cutting a hole, a leather loop is stitched on the flap with an opening wide enough to admit straps and girths.

The girths, flaps, and dock are now put in position. Then place the front of the panel against that of the tree, and press it in the centre just against the top of the tree. Having the pieces to be nailed on the centre of the board stitched to the panel, fasten them to this part with four or five small tacks, making sure that the panel lies close. Deal with the hind part of the panel in the same manner. Some harness makers always run a piece of lace from the centre of the panel to the centre of the tree in front, where it is nailed close to the tree.

The next operation is to cut the housings (Figs 100 and 101) or cover for the saddle top ; the width must be 5 in. to 7 in., and the length sufficient to reach from end to end over the tree by the side of the groove on each side. The length can be measured with string. Do not cut the ends square to the measurement, but bulge and round them so that they are 3 in. more along the centre. Narrow the front housing (Fig. 101) slightly for about 10 in. in

the centre so that it will rise there, and cut the part to be nailed at the back as before, namely about 6 in. wide on each side from the centre, narrowing to a sharp point at the lower end. The back housing (Fig. 100) being straight on the outside, begin to cut on the side about to be nailed from the corners upwards, narrowing an inch from the corner until it comes to a point in the middle. This improves the appearance and lifts the front from the shoulder, the back being thus made to match the entire piece. Make three rows around the edges with a race compass and run the lines deep with a beveller.

A brass oval or octagon may be placed on each corner of the housings at equal distances from the edge and end. Put these pieces in position and nail them to the tree through the centre ; then tighten

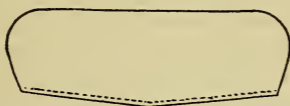


Fig. 100.—Cart Saddle Hind Housing.

them at each end with the seat awl or other strong awl, pulling down hard from the centre and driving in a nail on each side while tightening. Drive nails all along about 2 in. apart, being careful to make the edge of the housing quite flush with the edge of the tree so as to obtain the proper shape. The nails can then be covered with brass beading  $\frac{7}{8}$  in. wide, or a welt of the same width may be nailed down with brass or japanned head nails. Seven or eight stitches, nine per inch, must now be put in the lower part of the housing at the four ends through the flap, and will thus bind all neatly and firmly.

For the cart-saddle crupper, the body must be cut 2 ft. 6 in. or 2 ft. 8 in. long and  $3\frac{1}{2}$  in. to 4 in. wide ; cut a semicircle in the centre from the weak end, a point about  $\frac{3}{4}$  in. wide being left at each side

of the semicircle, and then cut an 8-in. piece to line with this end. Next cut a piece of leather  $\frac{7}{8}$  in. wide and  $8\frac{1}{2}$  in. long, shaving the ends thin. Stitch it with the edges together so as to make it round to within  $1\frac{1}{2}$  in. from each end. A cord or bit of leather may be placed in the centre to reinforce this; then rub it round and blacken it, and flatten both ends out with a hammer; this is for hanging the saddle on a peg.

The body that was cut first must now be pointed at the square end, the width being reduced to about 2 in., the same cut being made on each side. Race it along the sides and ends, then edge, black, and run a hot iron over the creases. Now prick it, about nine per inch, as far as the termination of the lining from the semicircle.

The ends of the round piece lately made are brought together and put under the points, one on each side; place the lining under them, and stitch it all round and across the points from side to side with a three-cord black wax thread, and trim, black, and rub the edges. Cut the lay 1 in. narrower than the body and 3 ft. long; turn it in 10 in. at the strong end and beat it flat. Turn it down 2 in. at the other end, and cut it slanting down to  $1\frac{1}{2}$  in. wide for a buckle of the same width; cut a hole for the buckle and run a line across the broad end 2 in. from the point, another in the same direction  $\frac{1}{4}$  in. from the end of the bend underneath, and a third  $2\frac{1}{2}$  in. from this part towards the buckle. Edge only the top, just reaching over the end of the broad bend; then make two lines of creasing and run a hot iron over them.

Inner lines are made about  $\frac{1}{4}$  in. from the innermost line, from the first cross line to the second, and from the third to the buckle. Two spaces are left for openings for the hip straps, one in the bend and the other in the middle; black and prick the parts to be stitched, four lines between the two openings

and four lines from the other side of the second opening in the direction of the buckle. Fix the buckle in place and lay it flat in the centre of the body, the extremity of the broad end of the lay reaching the edge of the semicircle; tack it down and stitch, keeping it well in position while working. Stitch coarse or spot along the three marked lines near the openings. The body is now finished.

A pad or panel is next needed. Cut some thick felt to the same width as the body, and long enough to reach from the point of the semicircle to 2 in. beyond the cross line near the buckle; cover it with basil, and coarse-stitch it with a pointed needle along the centre. Turn the ends neatly over the felt and fasten; then with stitches put it in place next the crupper body. Tack down each end, and run

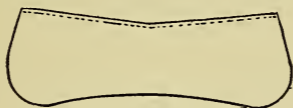


Fig. 101.—Cart Saddle Front Housing.

four or five stitches here and there through the body and panel; make sure that the work is well secured at each corner. Cut a hole through the body exactly opposite the buckle  $1\frac{1}{2}$  in. wide and broad enough to pass the strap; this is made 9 in. long, pointing one end and shaving the other. Crease and black it, and stitch the shaved end against the narrowed end of the body. When finished and punched, this will go round the dock in the saddle and fasten to the buckle on the lay, running down through the hole made in the body.

Sometimes, instead of the opening in the bend, an iron dee is employed for the crupper, and the hip straps are fastened thereto, a strap about 20 in. long being used on each side of the dee. This is a matter of taste, but care must be taken that the measurement from the second cross line to the ex-

treme end of the dee, when the lay is turned down, equals what it would be to the extreme end of the bend.

To make the breeching, cut the body, if possible, 7 ft. 4 in. long and about 4 in. wide. Turn it down to 4 ft. 10 in. long, the strong end less than the weak; edge and black, and crease two rows along the edges. Shave the ends, and mark a cross line about  $1\frac{1}{2}$  in. from the centre of the bend on both sides and at each end of the body.

Now cut some pieces 1 ft. long for lining between the two marks in the bend and shave their ends; bend them flesh outwards, leaving one end about 1 in. shorter than the other; otherwise it will be bulky when inside the breeching. Put it inside the bend after pricking the second row along the part having the leather doubled, and across the bend from one cross line to the other. When this lining has been tacked in the bend, stitch from row to row; this is the eye for the bridgeband pin used for fastening the chain. Trim the edges of the bend, blacken, and rub them with tallow and a bone; then tack down the double part as far as it goes. If, after being lined, the bend is rather hard, beat it with a wooden mallet and stitch the double part along both the ends and sides; then trim, black, and rub the edges.

The body is now ready for the lay, which must be of the same length and 1 in. narrower; edge, crease, and black it all along, and make another line with the compass  $\frac{1}{4}$  in. from the inner line of the crease. Prick the two innermost lines nine to the inch, and turn down the lay at both ends to the same extent as the body. Shave the ends and tack the lay in the centre of the body, the light end of the lay being placed against the heavy end of the body and inversely; pull it down close over the ends of the body and tack it in place.

Stitch all along the pricked part from end to end

to the cross lines, and spot or stitch cross lines, making the stitching bulge inwards at the middle to the extent of about 1 in. Make a hole with a large punch exactly in the centre where the stitches bulge inwards, and then, holding the round knife firmly in the hand, cut out straight at each side to remove a piece that allows the chain to enter and catch the pin. Cut another hole in the centre 1 ft. 4 in. from the ends by punching a hole  $1\frac{1}{2}$  in. farther on; then remove the part between the holes by two cuts, allowing space for the  $1\frac{1}{2}$ -in. tug to go through.

Prepare the two bridgeband pins and four  $1\frac{1}{2}$ -in. buckles to match those on the saddle and crupper. The pins have a dee at one end, and at the other a screw-thread with nut and washer to fix it in place. Two hind tugs 1 ft. 8 in. long must be cut from the leather, 6 in. being turned down at each end to meet the point; make a buckle hole in the weak end of each, and black, crease, and rub them. Prick the tugs from where the chapes leave the bridgeband to the loop or to the part which will have the loop. Place the strong end in the hole in the centre of the bridgeband from underneath, so that the joint will be in the front under the loop, and put a buckle on the other end. Make a loop about  $2\frac{1}{2}$  in. long and sufficiently wide to go round the two thicknesses of the strap. Make two rows of creasing, one at each end, and stitch the sides loosely together; then put the loop on the tug and stitch the end of the tug. Pull the loop over the joint and keep this and the stitches out of sight in the centre of the strap.

A safe must now be cut sufficiently long to run from the body of the bridgeband to an inch beyond the end of the buckle at the top and  $\frac{1}{2}$  in. wider on each side of the tug. Narrow the bottom to the width of the tug and shave it; round the other end, putting a loop on its extreme point in the centre, both the ends meeting. Stitch it for about  $1\frac{1}{2}$  in. along both sides through the safe; put the  $1\frac{1}{2}$ -in.

loop-stick in it, and black, crease, and finish. In the next place put the  $1\frac{1}{2}$ -in. iron loop-stick in the long loop on the tug and beat it gently until it is quite flat and square. Fasten it securely from underneath with about five nails on each side, clinching them against the iron loop-stick inside. Crease this again with a hot iron and put a fancy stamp with the maker's name or a neat creasing in the centre. Then put the safes in their places, fixing the loops on their ends just against the buckle at the top, and stitch the safe along the part pricked from the loop to the body of the bridgeband. Make two or four rows and strong cross-stitch the tug at the bottom. Now run a row of stitches across the top of the tug through the safe between the buckle and the loop.

Make both the tugs alike, and to prepare the tugs for the pins the loop is made as before, but it must be shorter because the tug with the dee-pin should have the same length from the body of the bridgeband as the hind tugs. Join the ends and make the safes similar, creasing the loops to a similar pattern; in fastening the safe to the tug, however, stitch a row only across the bottom and top of the tug, as it will be too short for more. Two loin straps 3 ft. 8 in. long by  $1\frac{1}{2}$  in. wide must be cut to fasten to the tugs and pass through openings in the crupper; point at each end, crease double at each side, edge, black, pass a hot iron along the creases, and make six or seven holes in each end to complete them.

The parts next to be made are a leading rein, a 1-in. strap with a billet and buckle at one end and a chain with a spring hook, called a cheek, at the other. Black and crease the rein, and then stitch on the buckles, billet, and chain.

The billet is the piece of leather stitched under or behind the buckle for fastening this particular end to any object. Make the billet 1 ft. long. The full length of the rein must be about 8 ft. 6 in.; the

chain by which it is fastened to the horse's mouth is put through the near ring and secured with a spring hook to the opposite ring. The billet end is fastened to the crupper of the leader or the shaft horse. This is very useful when horses take fright, as the driver may then be able to catch the rein and pull them in, though unable to reach their heads.

The  $1\frac{1}{4}$ -in. hame straps are simple straps with a buckle and loop at one extremity, the other end being pointed with holes. Their length is about 1 ft. 8 in. ; they are employed to secure the hames at the top.

Some harness-makers, for the purpose of ornament, make, for cart horses, a breast-plate which extends from the bottom of the hames and collar to the fore girth of the saddle or to the belly-band of a leader. It is made of leather, bound with red or yellow leather or American cloth, and the sides are scalloped, and have two or three face-pieces placed opposite the swell in the scallop, these face-pieces being a little narrower than the leather. A narrow strap runs from underneath through a hole, catching a loop at the top of the face-piece, and then down through another hole, and so on to the next.

When the strap is run all along, fasten the end at the bottom, the other extremity being secured by the billet, and buckle to the hames at the top. Run a strap about 2 ft. long from the base of this scalloped part, and furnish it with a buckle. Put it on the reverse way and bring the other end through the buckle, fastening it thereto ; stitch the end to the bottom of the scalloped part, the other end being furnished with a loop through which the girth may pass. The part underneath the face-pieces may, before being bound, be covered with coloured leather to give it a good appearance.

Now cut the cart belly-band 3 in. wide and 3 ft. 8 in. long ; narrow it down to 2 in. along a length of 6 in. at both ends, and, without bending

the band, cut a buckle hole about 3 in. from the point. Make two billets 2 ft. 2 in. long and 2 in. wide, and edge, crease, and black everything. Two loops must also be made about  $1\frac{3}{4}$  in. wide. Prick the billet, six per inch, for about 6 in. from the shaved end, and adjust the buckle and billet, making the latter lap over the buckle for 3 in. lower down. Place the loop about 1 in. from the buckle, tack all down, and stitch with a six-cord black wax thread, twice waxed; then make two or three stitches in the centre of each end. Having opened and creased the loops, make four holes in the billets; finally, give them a coat of Harris's liquid or composition.

## CHAPTER VIII.

## FORE GEAR OR LEADER HARNESS.

THE bridle and collar for a fore gear or leader harness must be made in the way described in the previous chapters, and will require no further explanation here.

The back-band A (Fig. 102), long crupper F, and belly-band D, still need description, however. Cut the crupper from good leather 3 ft. 8 in. long and 5 in. wide, and make a split 9 in. long at the light end and another, 7 in. long, at the tail end, leaving the points of the slits in front of the full width, merely cutting a little out of the corners. Narrow the points at the tail end gradually to about  $1\frac{1}{8}$  in., and cut a little from the sides of each slit. A piece of leather must be cut to line a foot or so of the tail end, and a piece of soft leather 16 in. by  $3\frac{1}{2}$  in. for a dock. Damp the dock well and turn down both edges in such a manner as to overlap deeply along the centre, the ends having been previously shaved thin.

Now bring both ends together, making both sides meet flat, but not with the flat sides together ; then, taking hold of the piece on the flat in the centre, turn the lower edge inwards and upwards, still keeping the points together with the other hand. Nail each point to a board and keep all parts in shape until dry, when the dock will be firm. Edge, crease, and black the body, making two rows all round, rubbing the edges well and hot-creasing the lines. At the tail end prick the second line as far as the double runs ; if the dock is dry, put it between the lining and body at each end of the slit. Tack it down around the lining, and stitch.

A few egg-shaped stitches can be put inside the outer stitches through the body and points of the dock to keep the last in place ; trim the edges, and black, rub, and tallow them, and do the same inside the edges of the slits.

Cut two chapes to hold the buckles in front for fastening the crupper to the collar straps ; bend the chapes down about 4 in., shave one end and point the other. Cut a hole for the buckle and prepare the chapes for stitching ; then, having two loops ready, about  $1\frac{1}{2}$  in. wide, tack them in their places, keeping the outside of the buckle exactly level with the end of each slit and the chapes right in the centre. Stitch them down, put a cross stitch on each side of the buckle, and shape and crease the loops. Now cut the crupper lay 1 ft. 3 in. by 3 in., and turn it down for about 1 ft. at the good end ; shave the end of the short turn thin, and round the other end ; then edge, crease, and black the lay.

Cut two hip straps H (Fig. 102) 2 ft. by  $1\frac{1}{2}$  in., and turn them down for 3 in. at the heavy end ; then shave the turn down, point the buckle end, and crease and black the straps. Attach them to a 3-in. japanned or tinned dee, one strap on each side ; stitch four rows in the double of each, and rub and finish the edge. Prepare two more straps in the same manner, each 2 ft. 10 in. by  $1\frac{1}{4}$  in., and stitch them in the middle round part of the dee between the two other straps. These are the carrier straps L (Fig. 102) for the stretcher ; the hip straps are for carrying the traces.

The straight part of the dee is now put in the bend of the lay and placed on the centre of the crupper body at the same distance from each side, the extreme point of the dee being within 8 in. from the points of the tail slits. Tack down and stitch two rows  $\frac{1}{4}$  in. apart all round, eight per inch, with three-cord thread ; then stitch the lay coarse, or spot it across just to the dee. Some makers put a

pad under the crupper as with the cart-saddle crupper, running it from the end of the tail slit to 1 in. beyond the point of the lay.

Hip-strap tugs K, must be made to buckle to the hip straps running from the dee, and for hooking in the traces. Having a pair of  $1\frac{1}{2}$ -in. hip-strap chains (Figs. 103 and 104), cut the tugs 10 in. by  $1\frac{1}{2}$  in. ; bend them so that the points meet in the centre, and cut a hole for the buckle in one end. Stitch the points together and put in two narrow

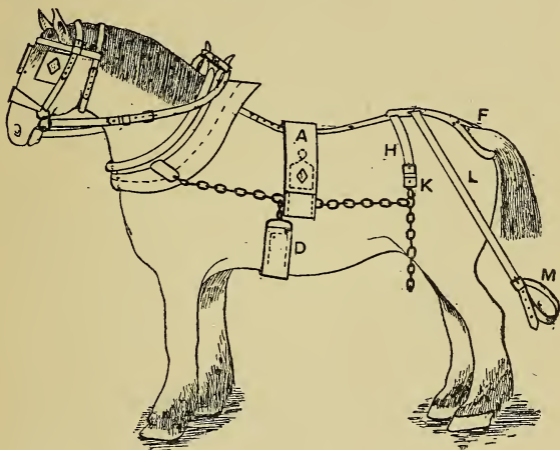


Fig. 102.—Set of Leader Gear.

loops, one to be used to hide the joint, or have one single broad loop for the same purpose. Place a safe underneath the same as on the bridgeband fore tugs, but stitch it instead of nailing.

In the next place make the tugs for the stretcher carrier strap M (Fig. 102), and a strap  $1\frac{1}{4}$  in. by 1 ft. 2 in., and in the last bend a chape, and cut a hole for the buckle. Stitch the buckle on with a loop and make a running loop and a hole 1 in. from the point of the strap.

When placing the carrier straps in position, fix a loop on each end of the stretcher and nail the ends of the latter, leaving space for the strap to pass. Run the strap down through this loop, the runner loop having previously been put on the strap; then pass it through the runner loop to the buckle, where it is fastened. Secure the carrier straps to the same buckle over the carrier straps, bringing their points down into the loop. Keep the runner loop down by the stretcher to tighten the tug and to produce a neat finish.

The hip straps must now be buckled in the tug buckles, the hook fastened to chain traces, and the collar straps buckled in the fore-slit buckles. Whether the dock is put under the tail is optional, because the hip straps, when fastened in the dee, suffice to keep the crupper in place.

The back-band A, to carry the traces, is the next part of the harness to be made. It must measure about 4 ft. 4 in. from tip to tip, including the terminal chains or the eye, to which the traces are hooked. If pipe, the leather must be made 6 ft. 4 in. by 5 in. Mark a cross-line 1 ft. from each extremity, and another 6 in. from each line, so that there will be 3 ft. 4 in. between the two middle marks. A piece of lining is required for the part between the two lines at each end; this should be of the same width as the back-band and 1 ft. 3 in. long. Shave thin both tips of the lining and also the ends of the turn-in of the back-band; crease, black, and rub the back-band, the crease being made from the extreme lines right along. Prick the piece from the outer cross-line at each end as far as the double will run, making five rows with two on each side; then put the lining under the space between the two lines so that it is 6 in. over one and 3 in. over the other.

A narrow piece, shaved at the inner edge and about 6 in. long, is now placed on both ends at

each side of the 6-in. space to strengthen the eye. Stitch the four rows in the 6-in. space, between the two lines, with three-cord thread, eight per inch; turn the edges of this part and black and rub them. Now turn down the ends, bringing the cross-lines dividing the eye exactly opposite each other; flatten the eye so as to bring the parts with the lines close together, and tack it in this position. Take two 1-in. dees and place a piece of leather inside them, on the flat side, for about half their width. Put both on each side of the back-band, one in each end between the double close to the eye and low enough to stitch through the piece of leather inside, when stitching the outer row.

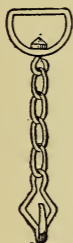


Fig. 103.



Fig. 104.

Figs. 103 and 104.—Hip-strap Chains.

The dees must be tacked down as well as the double; fasten it right along both sides. The four rows at both ends and sides are stitched to the top of the double from the cross rows. If desired, a fancy wave or pattern can be made instead of the two inner lines of stitching. Then stitch or spot with lace across the back-band along the cross-lines near the eye; open out the last by placing a thick piece of wood, etc., inside.

Two straps must be cut 10 in. by  $\frac{3}{4}$  in., a buckle and loop being adjusted to one end, and four or five punch holes made at the other for the dee

fixed at the side of the back-band to pass through a link in the trace, and thus secure the back-band.

Some harness-makers line back-bands from one end to the other and stitch them; others line the inner part of the eye with sole leather, and place a safe under the eye. This safe is about 1 in. wider at the bottom, and narrows down to the same width as the back-band at the top; the lower corners are rounded, and then it is stitched in from the eye upwards.

For the belly-band *D*, a pair of 3-in. chains is required, and the leather must be cut 3 ft. 4 in. by 3 in. Turn in 4 in. at the ends, and shave, edge, black, and crease them; then put the leather into the openings in the chains, stitch four rows along the double part, and spot or stitch across near the chain.

The set of shaft and chain gear, as described in Chapters V. to VIII., is now complete. The chains are attached to the shaft harness or jambles to pull from the shaft, while the leader harness has only a hook for hitching the chain traces.

## CHAPTER IX.

## PLOUGH HARNESS.

IN plough gears the ordinary bridle and collar are employed. The back-band is made in various ways. The method with hooks is taken first. The eye of the hook (Fig. 105, p. 109) is 4 in. wide. Cut the leather 3 ft. 9 in. long and 4 in. wide; turn down 3 in. at each end, and beat the bend slightly with the hammer to keep it down, and crease it with the screw-*race*, making two rows on each side; mark the centre from each end, and draw a line straight across at this point, then two lines each 5 in. from the centre, so that the distance between them will be 10 in.

Cut two pieces of leather  $10\frac{1}{2}$  in. long and  $\frac{3}{4}$  in. wide; dye and crease one side of each piece, having previously cut a small piece out of each corner of the side being worked. A line must then be drawn with the compasses along the centre of this narrow piece. Make a mark across the centre, and place it underneath the back-band, centre to centre, as far as the line just drawn; tack it down for stitching, and place the other piece in the same manner on the other side, so that the pieces may be a little over both lower lines at each end. This piece is called the facing; the place on the back-band where the pieces are to be stitched is pricked out before tacking them down. The work of stitching is now commenced, care being taken to keep the line close to the edge of the back-band; make the thread of three or four cords of coarse hemp.

Having a  $1\frac{1}{2}$ -in. tinned *dee* at hand, cut a piece of leather  $1\frac{1}{2}$  in. by 4 in.; shave and point both ends, then crease, black, and prick them like the side, with eight or ten marks per inch. Place the *dee* in

the centre of this piece, and lay it flat on the back-band in the centre, measured from both sides, or from the top line to either of the lines below, and then stitch, having tacked it down. When ploughing is being done, the rein is run through this dee, and there must be one dee on each back-band on the opposite side when the horses work in pairs, but for a single horse there is one on each side of the same back-band.

The next part to be made is the panel, used for preventing soreness of the back of the animal when ploughing, brought about by the constant pressure in one place. Take a piece of linen, or basil leather, 14 in. by 7 in., and lay the back-band on it centre to centre, and evenly over both sides; make the spot stitch thus // // // across the back-band, and through the linen along the middle line. Then the partition between the two sides will show the object of these facings, which make the pad slightly wider than the back-band, and so ease the horse's back.

Having stitched across the centre, turn in the lining all round about  $\frac{1}{2}$  in.; if, however, the material employed is basil, no turning is required. Make a pleat at each corner of the end of the facing, making both exactly the same length; put another pleat opposite the first, so that the width may be the same as that of the back-band and facing combined.

If the panel is basil, the corner is cut off to obtain the true length, and then stitched together where the cut was made instead of making a pleat. Now begin to stitch all round, commencing about  $1\frac{1}{2}$  in. from the centre on one side so as to have an opening for stuffing. Work round along the cross lines at the bottom until within  $1\frac{1}{2}$  in. of the centre of the other side in a direct line from the starting point. Spot-stitching is executed in the usual style.

Stuffing is the next operation, the flock being put

through the opening left on each side of the centre line. Lay the back-band flat on the bench and stuff each side rather tightly by the aid of the stuffing-stick ; the leather side of the back-band is underneath, whilst the openings are near the edge of the bench. Smooth well towards the sides, and flatten with a mallet, and continue the stitching along the opening to the starting-point ; this completes the top.

The hooks must now be put in, an operation which is performed as follows: Cut two saving pieces from a thick, firm face of hide ; good, close-grained stuff is wasted on such work as this, the best material, as a rule, being that from the face of a gear hide. Cut the pieces 7 in. long, and if the back-band is to be 4 in. wide, make the pieces 5 in wide. Cut one end slanting to 4 in., of the same width as the back-band, and shave it. Round off the corners of the other end, leaving it the full width ; black and crease the edges.



Fig. 105.—Plough Back-band Hook.

Put the hooks in their places and the saving pieces under them about  $1\frac{1}{2}$  in. lower down than the extremity of the hook ; tack them down exactly in the centre. Having marked and pricked the back-band with four rows running from the hook upwards to the end of the saving pieces, stitch with a four-cord thread, nine or ten stitches per inch, and then stitch a line across close to the hook to bind all together. Now the back-band is in working order.

The plough back-band, with chains instead of hooks, is made in exactly the same manner, but when there is only one chain and a bar across in the bend to hold it, a hole must be cut in the centre of the bend for the passage of the chain. For two chains and a bar make two holes ; the saving pieces can be made a little narrower with chains, and the body of the back-band need not be so long in pro-

portion to the length of the chains. As a guide in determining the length of the body, whatever may be the length of the chains or hooks, it should be remembered that the length of the back-band over all must be about 4 ft. 4 in.

Couplings are also a necessary part of plough gear. In some localities only cross-straps are employed from mouth to mouth when ploughing in pairs. Cut the strap 1 in. wide and 28 in. to 30 in. long, turn it in about 1 in. at each end, and make a hole for the buckle, and shave the points. Take two billets of the same width, 1 ft. long, and trim them to a point at one end, shaving the other; then edge back, and crease them; place the buckle in, and then the thin end, 2 in. down at the back of the buckle. Put a loop between the chape by the buckle and stitch one billet and buckle at each end; punch two holes in each billet.

Sometimes two coupling straps are employed for a pair: the straps cross each other from the hames of each horse to the mouth of the other. They are made to the first style, but longer, being 38 in. in length, each with 12-in. billets; in some cases they are made a foot longer than this, the coupling being cut into two, one end 15 in. long with a buckle and loop, and the other made to buckle on, with numerous holes for adjusting the length. This is a very convenient method, for when a young horse is coupled with an old one, the coupling must be shortened on the side of the former animal to keep it back until it has learned the ordinary working pace.

## CHAPTER X.

## BITS, SPURS, STIRRUPS, AND HARNESS FURNITURE.

BITS, their patterns and materials, will now be considered. Bits are made in polished iron, tinned iron, in steel of various qualities, and in nickel. Nickel is as expensive as good steel, but does not

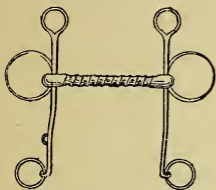


Fig. 106.

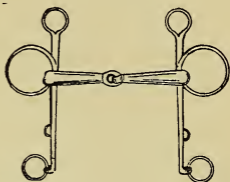


Fig. 107.

Figs. 106 and 107.—Pelham Bits.

tarnish so soon, and when worn still continues to take a good polish.

Some of the more expensive kinds of bits have



Fig. 108.



Fig. 110.



Fig. 109.

Fig. 108.—Pelham Bit. Fig. 109.—Hackney Bit.  
Fig. 110.—Bridoon.

ornamented and silver-plated cheeks ; this is especially the case with carriage, military, and riding bits.

Riding bits are snaffles for a single head bridle and rein, hence their name snaffle bridles. Pelham bits (Figs. 106 to 108) are used for single head bridle and double rein, this bridle being known as the



Fig. 111.



Fig. 112.

Figs. 111 and 112.—Ladies' Horse Bits.

Pelham. The Hackney bit (Fig. 109) has a bridoon (Fig. 110), that is, the bit has only a mouthpiece and a ring at each end with a jointed bar. This bit is used for the Weymouth bridle, which has a

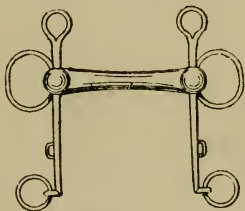


Fig. 113.

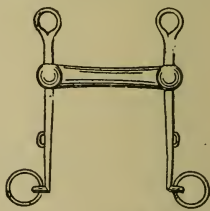


Fig. 114.

Fig. 113.—Pelham Snaffle with Indiarubber Mouth.

Fig. 114.—Hackney Bit with Indiarubber Mouth.

double head and a double rein. Curbs are used with the two bits last mentioned.

Bits for horses to be ridden by ladies are shown by Figs. 111 and 112. They are on the same prin-

ciple as those previously mentioned, but are lighter and more fanciful, many of them being ornamented about the cheeks. The Pelham snaffle (Fig. 113) and the Hackney bit (Fig. 114), with indiarubber

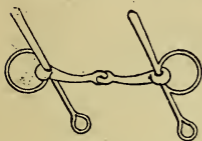


Fig. 115.



Fig. 116.

Fig. 115.—Gig Snaffle. Fig. 116.—Wilson Snaffle.

mouths, can be had for tender-mouthed horses, and double or twisted or smooth-mouthed bits can be had for vicious or quiet horses as required.

Driving bits are commonly gig snaffles (Fig. 115) ; Wilson snaffles (Fig. 116) have rings at each end and two loose rings on the mouthpiece, one of which is

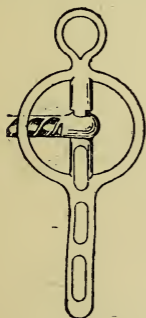


Fig. 117.



Fig. 118.



Fig. 119.

Fig. 117.—Liverpool Bit. Fig. 118.—Globe Cheek Curb Bit. Fig. 119.—One-horn Bridoon Bit.

buckled to the bridle cheek ; the outer ring on each side is for the driving rein, but sometimes the rein billet is put through both rings at the same time. Wilson snaffles can be obtained bar jointed,

twisted, or smooth-mouth. The Liverpool bit (Fig. 117) has a curb cheek, and a straight or solid bar

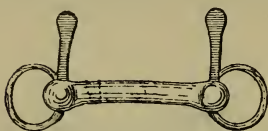


Fig. 120.—One-horned Bridoon with Indiarubber Mouth.



Fig. 121.—Gig Curb Bit.

mouth with the mouth bar loose on the cheek. The Globe cheek curb bit (Fig. 118) has a ring at the bottom of the cheek to which the mouthpiece is attached instead of being loose as in the Liverpool

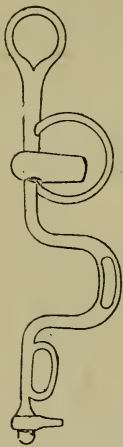


Fig. 122.



Fig. 123.

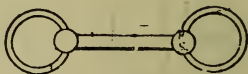


Fig. 124.

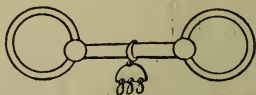


Fig. 125.

Fig. 122.—Buxton Bit. Fig. 123.—Swivelled Bridoon Bit. Figs. 124 and 125.—Breaking Bits.

bit. A "one-horn bridoon" (Fig. 119), with one ring at each side and either a solid or a jointed mouth,

sometimes has a leather or indiarubber mouth (see Fig. 120).

Gig curb bits (Fig. 121) have the billet of the

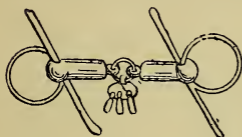


Fig. 126.—Breaking Bit.

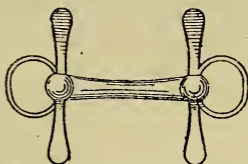


Fig. 127.—Snaffle with Indiarubber Mouth.

bridle fastened to the top of the cheek, with cheeks on the lower side to which the reins are fastened.

The carriage bit most in use is the Buxton bit (Fig. 122), which has a bend in the cheek below the



Fig. 128.



Fig. 129.

Figs. 128 and 129.—Exercising Bits.

mouthpiece, and a bar across at the bottom from one side of the cheek to the other, the solid mouthpiece having a port in the centre; this is a smart and very powerful curb bit, but it is being super-



Fig. 130.—Show or Stallion Bit.

seded by the Liverpool bit. A swivelled bridoon (Fig. 123), as sometimes used with the ordinary driving bit, has the bearing rein running from the hames down through the swivel and up to a strap stitched between the two slit straps of the head-

strap. Breaking bits (Figs. 124 to 126) are special kinds of patent bits. Fig. 127 is an indiarubber mouth snaffle; Figs. 128 and 129 are exercising bits; Fig. 130 is a show or stallion bit; and Fig. 131 is a double-mouthed snaffle.

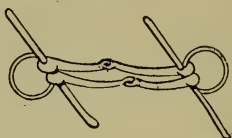


Fig. 131.—Double-mouthed Snaffle.

On the subject of spurs, very little need be said. Besides ordinary pattern spurs (Fig. 132), there are officers' regulation spurs (Fig. 133), dress spurs (Fig. 134), ladies' spurs (Fig. 135), trousers spurs (Fig. 136), and box spurs. The last-named are

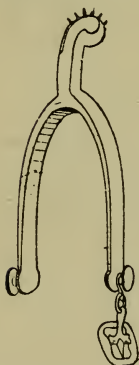


Fig. 132.



Fig. 133.

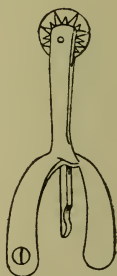


Fig. 134.

Fig. 132.—Ordinary Spur. Fig. 133.—Officer's Regulation Spur. Fig. 134.—Dress Spur.

fastened to the heel of the boot by a spring inserted in a steel box inside the heel. Like screw spurs, which screw into a hole in the heel, they may be taken off at will. Spurs are made in polished steel

and brass, some being silver-plated. The saddler must have a supply of spur rowels for repairing spurs.

Stirrups may be solid (Fig. 137), three bar or open



Fig. 135.



Fig. 136.



Fig. 137.

Fig. 135.—Lady's Spur. Fig. 136.—Trousers Spur.

Fig. 137.—Solid Stirrup.

bottom (Fig. 138), or they may be of the waving bar pattern (Fig. 139). They vary greatly in weight according to the purpose for which they are required, and are made of polished steel and of plated brass or silver. Ladies' stirrups (Fig. 140) are of various patterns, some having pads to protect the



Fig. 138.

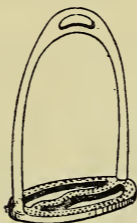


Fig. 139.



Fig. 140.

Fig. 138.—Open Bottom Stirrup. Fig. 139.—Waving Bar Stirrup. Fig. 140.—Lady's Stirrup.

foot, others having foot plates of the same shape as the foot; others, again, have slippers (Fig. 141). Safety stirrups (Fig. 142) both for ladies and gentle-

men are made so that if the rider falls or is thrown off the horse the stirrups spring open and release the rider's feet. Thus the danger of being dragged along the ground by the horse is obviated.

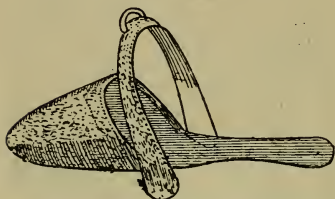


Fig. 141.—Stirrup Slipper.



Fig. 142.—Safety Stirrup.

Some particulars will now be given of harness furniture. First the material will be touched upon.

Japanned iron furniture is strong and durable, and has a fairly good appearance when new, but the japan soon wears off and allows the iron to get rusty. Common iron buckles, covered with leather, are also used, but not so extensively as they were formerly. The iron soon rusts, and the rust affects the leather and causes it to crumble off, giving a



Fig. 143.

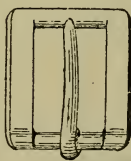


Fig. 144.

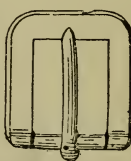


Fig. 145.

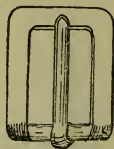


Fig. 146.

Fig. 143.—Flat Side Wire Front Buckle. Fig. 144.—Wire Front Bevelled Buckle. Fig. 145.—Bevelled Flat Top Buckle. Fig. 146.—West End Bevelled Flat Top Buckle.

very shabby appearance to the rest of the set of harness.

Brass furniture is largely used, and it is got up in many qualities and styles of finish. The best brass

does not tarnish nearly so soon as common brass, and, of course, has a good appearance when clean. Partly covered brass or plated furniture is also sometimes used, the buckles being covered with

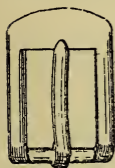


Fig. 147.



Fig. 148.



Fig. 149.

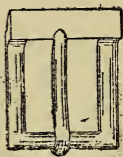


Fig. 150.

Fig. 147.—Spade Buckle. Fig. 148.—Square Wire Buckle.  
Fig. 149.—Chatham Buckle. Fig. 150.—Flat Top Turned-up Buckle.

leather about half-way up the sides, leaving the top and a little of the side bare. This looks very well, and is more durable than iron-covered buckles, as the brass- or silver-plate does not destroy the leather so soon as iron; partly covered furniture is, however, very awkward to clean.

Buckles are occasionally covered with celluloid; sometimes this only partly covers the brass, alu-



Fig. 151.

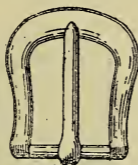


Fig. 152.



Fig. 153.

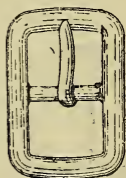


Fig. 154.

Fig. 151.—Fluted Buckle. Fig. 152.—Swelled Front Bent-leg Buckle. Fig. 153.—Flat Top Cab Buckle. Fig. 154.—West End Whole Buckle.

minium, or gold-plated buckle, and it then looks very rich. The celluloid-covered article is made in imitation of the leather-covered buckle; it is durable, and does not require much cleaning, the occa-

sional application of a wet sponge being sufficient. Celluloid is more commonly used in America than in this country. It is a very inflammable material, and will break if given a hard knock or if allowed to fall.

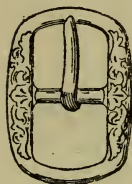


Fig. 155.

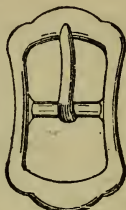


Fig. 156.



Fig. 157.

Fig. 155.—Chased Buckle. Fig. 156.—Melbourne Buckle.  
Fig. 157.—West End Square Buckle.

Nickel furniture looks well, but costs a little more than brass. Nickoline, white metal, or Victoria metal furniture costs about the same as brass; all three look well when cleaned, but quickly tarnish. Plated furniture is used on superior harness; it can be bought in different qualities; being plated with silver, white metal, German silver, or nickel.

Of course, the hames and the buckle tongues are

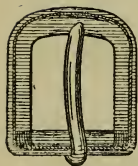


Fig. 158.

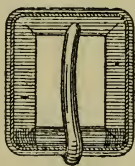


Fig. 159.

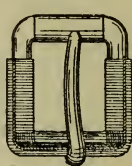


Fig. 160.

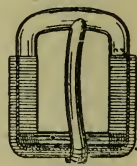


Fig. 161.

Figs. 158 and 159.—Covered Buckles. Figs. 160 and 161.—Part-covered Buckles.

of iron, plated in whatever metal the rest of the furniture is made; they have to be of iron to withstand the strain to which they are subjected. In ordering, it is necessary to state whether plated

hames are required of the same material as the furniture, and whether the latter is brass, silver-plated, etc. The pattern of buckle required will

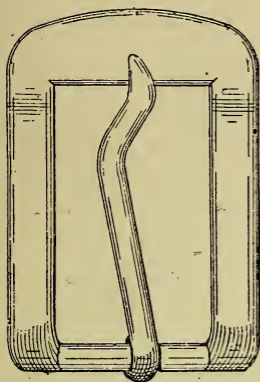


Fig. 162.

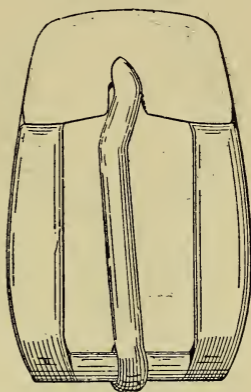


Fig. 163.

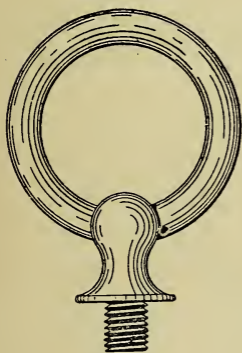


Fig. 164.

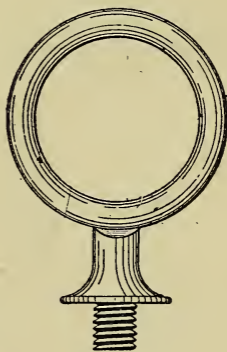


Fig. 165.

Fig. 162.—Shaft Tug Buckle. Fig. 163.—Burgess's Buckle.  
Fig. 164.—Ball Terret. Fig. 165.—Plain Terret.

make a little difference in the price; the wire-shaped pattern is the one mostly used.

There are so many patterns in gig and carriage furniture that it is impossible to mention them all.

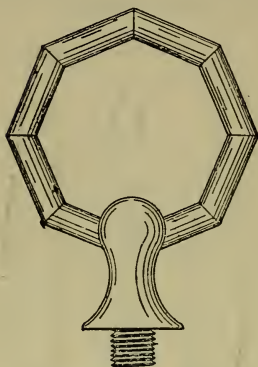


Fig. 166.

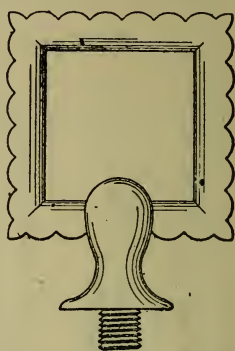


Fig. 167.

Figs. 166 and 167.—Ball Terrets.

Attention will be directed, however, to some of the most useful patterns of buckles. The flat side wire front (Fig. 143, p. 118), the wire front bevelled (Fig.

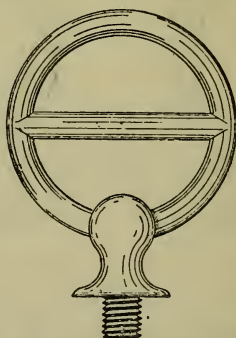


Fig. 168.—Ball Terret.

144), the bevelled flat top (Fig. 145), the West End flat top wire (Fig. 146), and the spade pattern (Fig.

147, p. 119) are all very neat buckles. Square wire buckles (Fig. 148) on light gig harness look very well. The Chatham (Fig. 149), flat top turned up

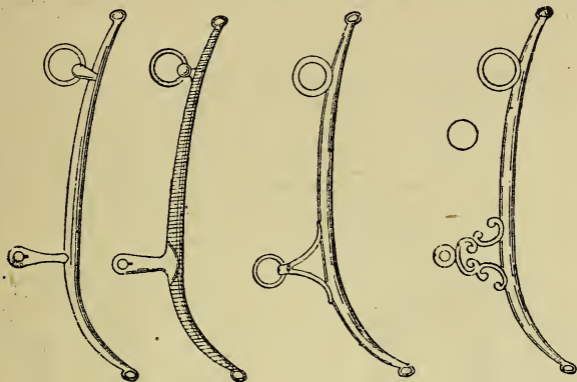


Fig. 169.

Fig. 170.

Fig. 171.

Fig. 172.

Figs. 169 to 172.—James.

(Fig. 150), and fluted (Fig. 151), are very strong buckles for cab harness, as are also the swelled front bent leg (Fig. 152), and side and flat top cab



Fig. 173.



Fig. 174.

Figs. 173 and 174.—Bearing-rein Swivels.

(Fig. 153) buckles. The West End whole buckle is shown by Fig. 154 ; it looks very neat for any fancy harness. "Chased" (Fig. 155, p. 120), "Melbourne"

(Fig. 156), or "West End square," or "square wire" (Fig. 157) whole buckles, are all very showy and smart when worked up. Figs. 158 and 159 are covered buckles, and Figs. 160 and 161 part-covered buckles.

There are many different kinds of shaft tug buckles; that shown by Fig. 162 (p. 121) is a good pattern, as is also Burgess's patent buckle (Fig. 163).

The terrets (Figs. 164 to 168) for the reins to run through on the saddle and hames (Figs. 169 to 172), as well as the bearing-rein swivels (Figs. 173 and 174) and all parts of the set of furniture, are of a pattern conforming with that of the buckles.

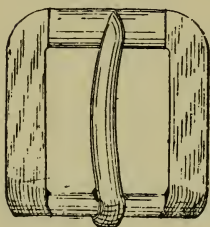


Fig. 175.

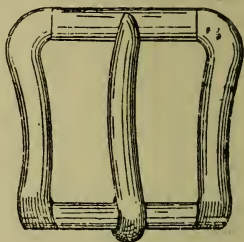


Fig. 176.

Figs. 175 and 176.—Roller Buckles.

Cart-harness furniture may be of galvanised or japanned iron, with buckles of brass or white metal. All the brass patterns illustrated are known as Scotch gear buckles. Cart fancy-brass breeching loops may be used instead of leather ones for bridgeband carriers and bridle cheeks.

Fly-terrets are much used as ornaments on the top of the bridle between the ears of the horse, being either screwed down into a socket or riveted in place. Brass face-pieces for the front of the bridles on the forehead can be obtained in numerous patterns.

Hame plates, to be put between the two points of the hames or jambles above the collar, look very

well with a strap across from side to side as a fastening.

Cart hames are either wholly or partly covered with iron, and generally take their names from the district in which the particular pattern is mostly used. Thus there are the Manchester, Lancashire, Irish, and Yorkshire hames. Cart bits, together with their fittings, are always firmly attached to the bridle, and are made either of tinned or japanned



Fig. 177.



Fig. 178.



Fig. 179.

Fig. 177.—Hame Clip. Figs. 178 and 179.—Breeching Dees.

iron. They may be straight and jointed, or twisted.

Chains, such as backband, crupper, or hip strap chains, and watering chains for bridle reins, and plough backband hooks or chains, are all wanted in making up a set. Others necessary are:—Leader backband chains, cheek chains for the end of leading rein, bridgeband chains, and chains for the bellyband, instead of billets, to go round the shafts.

Riding bridle buckles range in width from  $\frac{3}{8}$  in. to 1 in. Stirrup leather buckles are also a special

line, being from  $1\frac{1}{4}$  in. to  $1\frac{1}{2}$  in. in width. Saddle girth buckles are 1 in. wide. Roller buckles (Figs. 175 and 176, p. 124) vary in size from  $\frac{5}{8}$  in. to  $1\frac{3}{4}$  in., and are largely used on all kinds of leather work. Head-stall or head-collar buckles range in size from  $1\frac{1}{4}$  in. to  $1\frac{1}{2}$  in.; some have the collar attached, to which is fastened the throat lash.

The following buckles must also be kept ready to hand:—D-buckles for use on small straps; and japanned legging buckles, in sizes ranging from  $\frac{1}{2}$  in. to  $\frac{3}{4}$  in. Head-collar stop squares, for making and repairing head-collars, must also be stocked, as well as tinned and brass rings of different sizes, for making head-collars and for miscellaneous repairs. Brass, tin, and plated dees will be necessary for making and repairing dog collars, and for holding coat straps on riding saddles, etc. They range in size from  $\frac{5}{8}$  in. to  $1\frac{1}{2}$  in.

Belt, brace, and garter buckles may often be wanted, and 2 lb. or 3 lb. of buckle tongues for repairing old buckles should also be obtained in all sizes and strengths. Strong double-pronged buckles may be wanted from  $1\frac{1}{2}$  in. to 2 in. There may also be occasion to use harness buckles of all sizes, patterns, and material, saddle terrets, hame clips (Fig. 177), various kinds of nails, breeching and bearing-rein rings, breeching dees (Figs. 178 and 179), and rivets for clips, etc.

## CHAPTER XI.

## VAN AND CAB HARNESS.

THE making of a set of gig harness is described in the companion volume "Saddlery." Van harness for heavy work requires a set of furniture, including buckles, hames, and chains, and a van saddle-tree. The furniture should be of brass, nickel, or silver. Burgess's patent tug buckles (Fig. 163, p. 121) can be recommended for shaft tugs.

A pair of winker plates of any pattern (see Figs. 180 and 181) are necessary to make the winkers. Beginning with the winkers, cut the leather about  $\frac{1}{2}$  in. wider than the plate all round, except at the back, where it must be  $\frac{7}{8}$  in. wider. If patent leather is used, make a line all round the edge, and another about  $\frac{1}{2}$  in. from it, and race a line across,  $1\frac{1}{2}$  in. from the back part, from one end of the inner line to the end of the other; of course, the other lines must not be brought nearer than this to the back. Prick along the lines, about eleven per inch, and single stitch the inner line all round the four sides, through the leather, employing black linen thread double, with two needles.

Cut the lining to the same size as the top, but lightly stuffed and with little oil in; put the top on it and stitch all round three sides, leaving the back open. Put the leather in water and wet it thoroughly, and then, having opened out the two leathers with the hand, put a good coat of paste on both of the inner sides by the aid of a spoon or other convenient implement.

Push in the winker plate front to front; but if the front is round cornered, it must, of course, be

put in first. Push in the pieces until they lie square in the leather and close to the front stitches; then rub the top and the lining down to the sheet iron, being careful to make the lining stick well to the sheet.

Place the winker on a board, lining underneath, and tack down each of the hind corners, and if necessary, the middle; then put some paper or rags between the winker and the board so as to keep the lining up to the sheet. When quite dry and perfectly adhering, remove them from the board, trim the edges, finish and polish well.

The collar is made practically in the same way as a cart collar. The forewale must be turned down 2 in., that is 4 in. altogether, and instead of whipping the basil lining in as previously described, cut it a little smaller, and stitch it in at the same time as the forewale; tack it down in such a manner that when the lining is turned over to stuff the body, the stitches will not be visible. Take a pattern (see Fig. 96, p. 79) and let the lining overlap in the centre of the forewale for quite 2 in. Stitching is done as for a cart collar, both for the forewale and the drawing in the body, but the last must not be so big and clumsy.

In making and setting the top piece, no stitches should appear in front other than the cross row; the top piece must not be joined downwards as in the other. Turn in the bottom of the top piece for  $\frac{1}{2}$  in. across, and stitch a line with black linen thread  $\frac{1}{4}$  in. from the edge to keep the turn in its place. Damp the top piece, put it across the front, and draw it tight, putting a tack in both sides; then make it overlap at the top centre of the back so as to obtain a good point to hold the hame strap in place; then stitch all round the hollow.

Cut the side piece close along the sides of the body to fit tight by the forewale. Then take a piece of soft thin leather binding  $1\frac{1}{4}$  in. wide, damp

it, and place it edge to edge with the outside of the side piece, tacking it down. Having stitched the side piece, putting a small welt at the joint at the bottom, and shaving a little round the edges, stitch the binding and side piece together around the edge with black linen thread, about seven stitches per inch. Run a piece of twine along the stitches round the rim, and turn down the binding over the twine towards the inside, being careful to keep the twine in place. Mark a line and prick it, about eight per inch, and  $\frac{3}{8}$  in. from the edge; then stitch the binding down below the twine. The last must be in one piece with 4 in. or 5 in. to spare at each end.

Damp the side piece and adjust it; tack it with

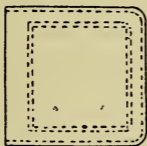


Fig. 180.

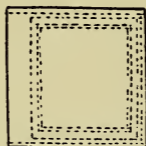


Fig. 181.

Figs. 180 and 181.—Winkers.

an awl at the bottom and draw it tight at the top. Now wax a piece of collar twine, about 18 in. longer than is necessary to pass round the collar, and begin to stitch the side piece in at the top on the off side, running the stitches through the binding close to the stitching and through the lining at every other stitch. The stitches may be about 2 in. long; draw them tight while working, and be careful that the side piece is in its proper position, with both sides equally level. Fasten the thread after stitching the side piece all round. Take hold of the hanging ends of the twine which has been run along the binding inside, and pull them well to draw down the edges of the side-piece along the side of the body; then knot and fasten them to-

gether. Draw in the side piece at the forewale as with the cart collar, using only thread or very fine white lace.

A layer of old carpet may be placed on the stitches next to the body under the side piece to give the sides smoothness and roundness. Fasten the two side pieces together at the top by stitching over from one to the other with the collar needle.

A small housing to cover the top of the collar must be cut, almost half-round in shape, but with slightly widening points and a V-shaped notch on the side next the collar for the points to pass, one on each side of the top piece; bring it down close to the forewale. It may be bound in the same style as the side piece, stitched fast edge to edge with the binding, the latter being then turned and a line stitched round a short distance from the edges; about  $\frac{3}{4}$  in. below that another row of stitches is made all round. The point on the outside of the body must not project more than about  $\frac{1}{4}$  in.

Plain or patent leather can be employed to make the collar and winkers; patent leather must always be marked for stitching with the race compass, and a groove cut so that the patent will be raced off and the line quite visible. This kind of leather, when used to make the collar forewale, must be lined with calico to prevent it cracking.

The van saddle (Fig. 182) is the next part to be made. The tree is a miniature cart-saddle tree, with similar boards and groove. The plates to be put in the point of the groove where the backband runs through may be nickel or brass to match the furniture. Begin work by fixing the terrets and bearing-rein stand hook on the tree. Take off the sockets which are attached to the screws, and see that they are of the proper length to reach over the groove of the tree from side to side; file them

down to the width of the tree if they are too long. Place the stand-hook socket exactly in the centre at the top, and mark its position on each side and end.

Cut out a hollow at the mark deep enough for the socket to enter and lie flush with the surface, and drive a small screw through each socket into the tree. The terret sockets are fixed in the same manner, being sunk level and screwed down, about  $3\frac{1}{2}$  in. lower than the stand hook on each side.

Cut two pieces of thin leather, either plain or patent, to the same shape as each side of the tree

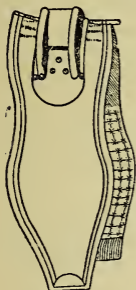


Fig. 182.

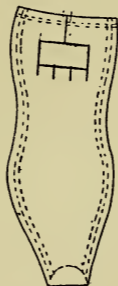


Fig. 183.

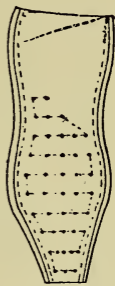


Fig. 184.

Fig. 182.—Van Saddle. Fig. 183.—Van Saddle Flap.  
Fig. 184.—Van Saddle Panel.

and about 1 in. larger each way. Damp them and make a nick at the top of the boards in the leather so that the centre of the piece will turn down underneath. Tack each end of the leather to the board close to the tree, then pull it tightly along the entire surface of the side over the top, nailing it here and there. Level it down on the surface of the tree, and tack the centre part between the boards underneath the tree, pulling it tight and flat over all parts.

To make the flaps, cut out a paper pattern as a guide (see Fig. 183), making it wider at the top

than at the other parts and slightly raised in front. The flaps must reach down from the lower part of the groove in the centre for about 15 in., swelling slightly at the sides and gradually narrowing to about 2 in. at the bottom. The patterns may also be cut straight without the swelling sides, but in both styles they must rise in front more than at the back; as they are cut in two pieces, one for each side, this can easily be managed, because when they are joined at the top this part will stand out prominently in front.

Some flaps are made with stout firm leather, others are lined. In the first case, make two rows along the sides with the race compass and bevel deep with a hot bevel; but patent leather, instead of needing the race compass, has tallow rubbed along the part to be creased and the lines are marked with the compass; then run a warm beveller deep along the marks, being careful that it does not cut the leather.

When patent or plain leather is lined, use the race compass and prick the grooves for stitching. When stitched (or made without lining), cut and polish the edges well and join them with a stitch at the top; place a piece of leather over the joint at the front about  $1\frac{1}{4}$  in. wide, and stitch it on both sides of the joint and across the front; then shave it thin at the side next the tree. A dee, of brass or other metal, is placed on the outside for fastening the crupper. Cover the joint at the back with another piece of leather, turning it down on the outside and shaving the other end thin. These pieces should be long enough on both sides to pass under the tree when the flaps are nailed. On these the tree is placed centre to centre and front to front, and a line is marked along the sides of the tree from board to board on the leather.

Make a mark at the lower side of the board to indicate the width of the tree there, and the width

of the wood on both sides of the groove. Note that this must be marked at the bottom side of the boards, four marks being made at each end of the tree, outside and inside the wood on each side of the groove.

At this point take away the tree, and cut a slit from the outer lower mark to the point of the one running along the side of the tree; there will then be two slits of the width of the board, one on each side of the tree. Now cut upwards from each of the two inner marks at the bottom, for the length of the other cuts and equal in width to the wood, on both sides of the groove. Then cut across the top of each incision from side to side; there will now be one cross cut and four cuts upward, and a portion along the centre. Cut the middle piece between the four slits at each end about  $1\frac{1}{2}$  in. from the bottom, and shave the points; now cut the two narrow strips at each end to the same length.

The middle piece, unless there are plates, is nailed along the groove with the narrow cuts underneath. Place flaps over the top and make the edges of the centre slit meet at the centre of the tree below. Nail the flaps down along the edge of the tree, putting four or five extra nails opposite the crupper loop in its chape. When there is no plate, nail the centre piece in the bottom along the groove; put the narrow pieces down and nail them with the brass beading, making sure that the part of the flaps over the boards runs close to the tree; fasten it to the boards with four or five tacks. Turn the centre piece down like the narrow ones, and nail it to the board at each end.

Cut a top cover of strong leather of the same width as the tree and to reach to within  $2\frac{1}{2}$  in. from the bottom, so that there will be an opening for the backband; crease it across both ends and bevel the creases with a hot iron, or line both ends for about 2 in. and shave the inner side; then make two rows

of stitching across the points. Place it on the tree in its proper position, and give two or three light taps with a hammer opposite the three openings for the terrets and stand hooks in the sockets; thus the size and position of the holes is marked on the cover.

Holes, of the same dimensions as the socket holes, must now be cut in the cover, and this nailed down on both sides of the tree, keeping the holes in the leather exactly opposite those for the sockets. A strong nail must be driven into each corner so that it will not be prized up by the back-band. Take a piece of beading long enough to run along the top on each side and go down underneath through the opening opposite the narrow cuts in the bottom; nail the beading on the side of the boards or under them, securing in the same way the narrow turned-down strip. The beading should lie close to the leather along the top of the tree; drive the nails for the beading with a wooden mallet.

The saddle is now ready for the panel (Fig. 184, p. 131), the back of which must be cut to the same size as the flaps; it must not reach quite to the bottom; let it end, say, 2 in. from it. Basil can be employed as material, and if this is light, a piece of linen can be pasted inside, or a narrow slip may be pasted along the edges. When dry, see again that it is of the same size and shape. The facing must be cut about  $1\frac{1}{8}$  in. wide, and of the same length as the sides of the panel; it may be in patent or plain leather to match the flaps.

When the material is not long enough it may be cut into two parts and joined at the centre; it is then tacked along the edges and stitched for about six inches. Rub the joint down as flat as possible. Take some blue serge lining or collar lining and lay it out smooth on the bench, and place the panel back on it inside out; with hemp, tack it along

the sides to the lining, cutting the latter to the same shape as the back, but wider by  $1\frac{3}{4}$  in. or more on both sides at the top. The lining then tapers to exactly the same width as the base at the extreme point. Narrow the lining at the gullet and, just at the back in the centre opposite the opening to be left, turn it in about  $\frac{1}{4}$  in. ; run a stitch to keep it down, and then whip it in with the facing from end to end and across the bottom, employing black linen thread and a pointed needle and thimble. No facing is placed across the bottom.

Now turn the panel inside out through the opening at the top ; the joint is not stitched right across, only two or three stitches being used at each end. Some piping is now needed to run round the facing to make both sides of the panel front stand out round and straight.

Sometimes the facing is made of straw whipped round with hemp until it is hard and round ; sometimes with damp brown paper rolled with both hands on the bench ; or a simple cord of light twist may be employed, and, in America, cane. In harness of this description, cord will suffice ; it may be covered with brown paper to about  $\frac{5}{8}$  in. in diameter. Place it in the facing through the opening at the top, making it reach to the bottom at each side but not across. Turn the facing tightly over it and begin to spot from the back, the stitches being small and even on the lined side.

While working, the panel should be kept flat on the bench, the lining being uppermost and being stitched close to the facing with a quilting needle and thimble. Then place the lining flat and even at the top, parting it alike on both sides and running a line of cross stitches from side to side on both sides of the joining at the back, to about  $1\frac{1}{2}$  in. apart at the back and about 4 in. in the front.

The panel is now in two compartments. Cut two openings across it, one on each side, below the

line of stitches just made, and one to cross them ; then stuff the panel with carded flock through these openings, the stuffing-stick being employed for the purpose. Fill it level from top to bottom, but not too full.

Next mark, say, six cross lines, about  $1\frac{1}{2}$  in. apart, from the bottom of the panel towards the top, a rule being used as a guide. Take a long three-cord black hemp thread made with beeswax and quilt it, making four stitches or so in each line ; use a thimble and quilting needle. Keep the stitches in a straight line both downwards and crosswise, and when the last line is reached, make two stitches from back to front, thus leaving the last line half finished. Now flatten it over the stitches and stuff the top to the requisite thickness, taking care to make it firm, though not hard, otherwise it will become very thin when pressure bears on it. Place the panel to the centre of the tree and flaps, and put a tack on each side at the top to retain it in this position. Some harness makers run five or six stitches through the flap and panel here and there, others spot them all the way along ; but the best method is to put the panel in with copper wire.

Stitching or spotting might do for common work, small stitches being put in spotting on the flap side and about  $1\frac{1}{4}$  in. apart below. The stitches, whether spotting or stitching double-handed, should run out in the hollow between the facing and stuffing below. Keep the facing even along the edge of the flap a little outside rather than underneath.

To fasten a panel, cut the wire into pieces about 5 in. long, and with a bent awl cut holes underneath the flaps close by the outer row of stitches, all at the same distance from the outside. Then place a piece of wire in each, and, if for a gig or cab saddle, nail the panel in the centre on both sides ; but in

the case of a van saddle, nails need not be employed ; simply wire it all round. Keep the panel right in the centre and fasten a wire in the top, on each side, by cutting a hole with the bent awl for each point of the wire just below the facing. Put one wire in each hole and push the panel close to the flap ; then twist the wire on the panel side with a pair of pincers till the panel is pulled tight to the flap. Give the wire a sharp twist with its points together, and cut them within  $\frac{1}{4}$  in. of the panel ; turn down the points and press them out of sight into the hollow between the panel and the facing, repeating the process along both sides with the wire about  $2\frac{1}{2}$  in. apart.

A strap and a girth are needed to fasten to the bottom of the flaps. Cut the girth 2 ft. long and 2 in. wide, and have a lay to put on about 9 in. by  $1\frac{1}{4}$  in. Make a buckle hole in the lay so that the edge of the buckle will be level with the end of the girth, as the chape is not to be turned down, but is stitched on the flat.

A strong strap must now be cut 18 in. by  $1\frac{1}{4}$  in., rounded at one end and shaved at the other, and another piece of leather 2 in. by  $4\frac{1}{2}$  in., with one end shaved and the other narrowed to  $1\frac{1}{4}$  in. ; edge, black, and crease both. Tack the lay on the girth with the buckle level to the end, and narrow the girth to the width of the lay at the point ; then place two loops beyond the buckle and stitch the lay. In the next place, the shaved end of the strap must be stitched to the  $4\frac{1}{2}$ -in. piece, the strap being placed within 1 in. of the broad end. Finish the loops, punch the straps, and stitch them, the strap on the near side and the girth on the off side at the base of the flaps, the stitches running across and in a half circle from corner to corner.

The winkers by this time will be dry and fit to work as part of the bridle. Straighten the outside—that is, the part to be stitched—if it has got a

little out of shape in wetting and nailing. Rub the other edges with sandpaper and give them a fine polish; then shave the side for the cheek.

Having got four  $\frac{3}{4}$ -in. buckles ready for the cheeks, cut the latter 2 ft. 9 in. by  $\frac{3}{4}$  in. and measure 1 ft. from the better end, marking it across for a billet. Now round its point and measure 8 in. from the first mark; turn it down there, and again turn it down 8 in. from the bend. Make a buckle hole in each bend, and edge, black, and crease along the billet part. Make a groove with a round knife or grooving tool underneath on the billet side from the cross mark to within  $\frac{1}{4}$  in. of the top bend, the depth of the groove being about half the thickness of the leather; open it out with the point of a blunt compass or anything suitable.

The buckles can now be fixed; one in each bend, and the winkers can also be placed between the cheek up to the buckles at the top bend and level with the outside. Cut a small nick just opposite the projection of the buckle tongue so that the winker will ascend on the top end close to the buckle. See that the point of the turn-down running from the base bend is cut level with the bottom of the winker, and run a stitch through both, making the point fit tightly in the hollow between the lower buckle and the winker.

Place three tacks on the outer side to keep the edges together in their places. Make one loop for each from medium heavy winker brown loop leather about 7 in. by  $1\frac{3}{8}$  in.; damp it well and place it in half the width of the cheek on the inner side and stitch along the groove. Adjust the two sides in the same manner, reversing the winker to pair them.

The loops having been damped before being attached, place a loop-stick  $\frac{3}{4}$  in. wide in each loop; then knock them square and level to shape. Black them with soda and dye, dry partially with rag, and

rub and polish well with a bone, making them shine brightly. Now trim the underside of the cheek, round the square edges, and polish. Apply a coat of Harris's harness liquid both to the loops and to the edges ; rub them well with the palm of the hand and then with a little tallow, after which they must be again rubbed with a rag.

The loops are now ready for creasing and checking, but in the first place make sure that the loops are in condition ; if too dry, they cannot be creased deeply enough, and if too wet the bevels and marks cannot be polished. Test with a hot crease and then hold them near the fire a little while ; finally rub with the hand until they are dry enough. Attention must also be given to the temperature of the tools when heated in the fire, candle, or gas. Therefore, keep on the bench a small quantity of water into which to dip the heated tools ; if the beveller or checker hisses in the water it must be kept there until this ceases.

Now with the screw crease or compass make two or three lines across each end of the loop, and two rows near each other along the edges on the face. Trace out the design on the surface between the outer lines, namely diamonds, single arrow point, or double arrow points, etc. Having warmed the beveller, mark deeply the cross and outside lines, polish them, and then mark the outer lines of the design with the beveller on the surface of the loop.

The space between the outer lines of the design and the straight lines at the edge and sides must now be marked with the warm checker, which may be fine or coarse, according to the style of work ; the design also will vary with the fineness or coarseness of the work. The checking being finished, run the beveller along all the outer lines in the design and the straight line, to smooth down the checker marks running to the bevelled lines and to give boldness to the work.

The noseband is made by cutting the leather 2 ft. 8 in. long by 1 in. ; it must then be marked 5 in. from the point and again at a distance of  $\frac{7}{8}$  in. from this mark ; then a third mark is made 13 in. farther on, and a fourth  $\frac{7}{8}$  in. from the last mark. Turn down 2 in. of the end marked last for the buckle ; take  $\frac{1}{8}$  in. from each end and each side as far as the cross mark nearest the ends. Make a buckle hole and shave, bend, and round the other end for the point. Cut another piece for a lining, taking the first as a pattern, and then thin the edges of both, slanting from the middle of the strap on both sides, but do not thin the  $\frac{7}{8}$ -in. space in either piece.

The first piece of leather that was cut with a buckle hole can now be damped ; then with a groov-



Fig. 185.—Chain and Leather Gig Front.

ing board and hammer handle a groove is made along the full length, not including the two  $\frac{7}{8}$ -in. spaces. Now cut a hole in the outer side of each of the cross lines, marking two spaces, and cut two loops about  $\frac{3}{8}$  in. by 2 in. Shave the points, damp, and put one end in each hole over the  $\frac{7}{8}$ -in. space ; beat the points a little to flatten them to the leather, and leave sufficient space for the billet to pass between the loops and the noseband.

Crease the noseband on both sides from end to end,  $\frac{1}{8}$  in. from the edge, and, if required, another line can be made at the same distance farther in from opening to opening in the centre only. Prick the lines all along except opposite the openings, fine or coarse, according to the style of work, and then put the lining underneath and the buckle in its place. Tack it here and there with fine tacks,

and with three-cord fine hemp stitch from end to end, around the point, and across at the end of the centre loops to fasten the loops near the openings.

Stitch a second line if needed, and then the buckle chape from underneath, and put in one or two loops. Trim the edges, sandpaper, black them, and polish ; then place sticks in the loops and finish, making four holes in the short end.

The next part of the harness to be described is the front or forehead band. Begin work by cutting it 21 in. by 1 in., bend it down to pass easily round a  $1\frac{1}{2}$ -in. strap, and then mark it across the length of the required opening. See that there are 13 in. between the two cross marks in the centre and sufficient to stitch down the ends beyond the



Fig. 186.—Chain and Leather Gig Front.

openings ; shave the points and stitch down the ends from the cross lines to the points.

It can be covered with fancy coloured or striped cloth or leather and herring-bone stitched along the centre underneath, making a cross at each end ; or a chain front (Figs. 185 to 187) can be employed. In the last case a piece of patent leather must be cut of the same length as the front from one cross line to the other and of the same width as the forehead band ; adjust the chain and stitch along its centre, taking the thread out at one side of the chain, and running it through the link and down on the other side close by the chain, and so on through every link ; at each end through the link joint make a little chape and stitch double through it when the patent leather is being adjusted to the forehead band.

Now mark a line along the edges of the patent leather outside the chain and prick it fine, laying on the patent leather from opening to opening, and stitching double with beeswaxed linen thread and a fine awl. Stitch the patent leather across also at the ends, catching the above-mentioned little chapes. Then pare, sandpaper, black, and well polish the edges.

To make the head-piece, cut the leather  $1\frac{1}{2}$  in. wide and 1 ft. 10 in. long; slit it 6 in. at each end, and edge, black, and rub it well, and then crease it with a hot creaser close to the edge and at both sides of the slits. Now cut a  $\frac{3}{4}$ -in. chape, long enough to clasp the buckle and the headpiece and to reach no farther than the far side. Make a buckle hole in it, and edge, black, crease, and finally prick it.

Cut a loop  $\frac{1}{2}$  in. wide, trim it and place the chape in the buckle, tacking it exactly in the centre of the head-piece, after having cut a small nick exactly in the centre for the projecting tongue to enter. Stitch it in place, running a line across at the end opposite the buckle; then make four holes in each of the slits.

The winker strap is made as follows: Cut it from stiff leather  $1\frac{1}{2}$  in. by 13 in. long and remove the centre piece with a punch at the top of the slit, the last being  $7\frac{1}{2}$  in. by  $\frac{1}{2}$  in. Beginning at the slit, gradually narrow the other part to  $\frac{3}{4}$  in. wide to run to the head-piece buckle at the top. Crease, black, and rub well with a hot iron and make three punch holes at the pointed end. Take the winkers and open a small slit by cutting the stitches between the leather at the top corner in the front; put a  $\frac{1}{2}$ -in. length of the slit in each winker and stitch the points there firmly.

All that is now required to complete the bridle is the throat lash; make it 2 ft. 3 in. by  $\frac{3}{4}$  in. and turn it down at each end to 1 ft. 8 in.; then make

buckle holes in the bend and shave the points. Edge, black, crease and rub well, prick the bend, and put in the buckles with the bearing-rein swivels, one at each extremity. Having made a loop or two between the buckles and swivels, stitch down the chapes, going below the swivel sufficiently to keep it in place.

Put the bridle together by passing the ends of the front piece into the rosette loops, and placing one slit of the head strap on each side of the rosette loops at both ends of the front piece, the centre buckle at the top pointing in the same direction as the front. Secure the winker strap at the top buckle, and both inner slits of the head strap in the top buckle of the cheeks; then pass the billet through the noseband opening. Make sure that the noseband is buckled on the near side, and then



Fig. 187.—Chain and Leather Gig Front.

put the billets through the cheek of the bit and up again through the loops on the outside of the noseband and cheek buckle.

The throat lash must now be buckled on the off side and the strap passed through the loop on the near side; the noseband being buckled, the bridle is finished. It may be coated with liquid blacking or composition before it is put together, and the buckles and rosettes can be cleaned with paste and washleather or a clean soft rag.

To make a bearing rein a middle piece must be cut 6 ft. by  $\frac{3}{4}$  in.; finish it and bend 2 in., making it ready for a buckle. Shave the end thin and cut it to a point; if two buckles are employed both ends must be prepared alike, but with only one buckle one end must be pricked for stitching to the

ring of the round part. Cut the round parts  $1\frac{3}{8}$  in. wide and 2 ft. long; turn them down and narrow them to  $\frac{3}{4}$  in. at one end, the turned-down part being 2 in. long. Turn down about 1 in. at the other end and prepare it for a buckle, shaving the point thin; then damp round the central part, bring the edges together, and cut a groove on each side to sink the stitches.

With a blunt point, open the groove before stitching and have a piece of cord thick enough to fill the inside and 1 in. longer at each end; unravel it at the ends and thin the strands by pulling off some of the material with an awl. Run one end of the cord through the bearing-rein ring for an inch and whip it round with waxed hemp so that it will be secured there.

Open the strands at the other end and put half of them on each side of the buckle tongue at the part which will be in the leather; whip this again fast to the buckle and see that it is of the right length inside the round to reach tightly from the buckle to the ring when in its place. It is now necessary to put the ring in the long bend and the buckle in the short one.

Now cut a billet 9 in. by  $\frac{3}{4}$  in., and after shaving one end thin, round the other and prepare and crease it. Put it in the billet and a loop, and stitch the other end fine in the ring; stitch the round along the groove, being careful to have the thread in the centre of the groove at both sides and to catch the points of the turn-down at the ring and the point of the billet in the other end, between the edges of the round part, making two or three stitches in each, thus joining them firmly with the round part. Then with the spokeshave trim them round and neat, rub with coarse glasspaper, and finish with fine; close the edges of the groove well over the stitches and try to make it look as much as possible like one round, solid piece.

After well blacking and polishing the bearing rein, give it a coat of liquid blacking, polishing by sharp rubbing; finish neatly around the ring and buckle, crease the loops, and make one or two holes in the billets.

Now prepare the middle part. When there are two buckles, begin by punching a dozen holes within 9 in. of each end; with one buckle of course only one end is punched. Five running loops large enough to pass over the strap double must now be made, as explained. When they are finished and polished, put the two points together through one of the loops and pull that loop to within 2 in. from the top; fix a buckle on each side and two loops after each buckle with the right side out. Now run the points through the rings to the buckle and put a chape in place, fastening the buckle in about the sixth hole from the end and leaving the chape unstitched. Then pull one loop over the chape close to the buckle and the other loop down to the ring on each side.

To make the crupper, cut out the body 2 ft. by  $1\frac{3}{4}$  in. and slit it for 8 in. at the strongest end; taper the other end to  $1\frac{1}{4}$  in. wide and cut a  $1\frac{1}{4}$ -in. billet 3 ft. 9 in. long. Shave the strong end thin and round the other; cut the lay 16 in. by  $1\frac{1}{4}$  in. and shave one end, rounding the other. The points of the slits and the end of the body must also be shaved, the slit points being tapered. Black and crease them all, only the top of the lay being edged.

Place the round end of the lay close to the slit end, in the centre of the body, and 4 in. from the round end make a deep cross line followed by three other lines at intervals of 2 in., and at the same distance from the fourth line cut a hole for the buckle; then put an awl at each corner formed by the cross lines into both lay and body so as to make a mark visible below; there will thus be a guide for

use when stitching underneath to indicate where to begin and end.

Cut a groove from the shaved end of the body as far as the first awl mark below, then from the second to the third, and finally from the fourth to a distance of about 1 in. towards the point of the lay; this groove must be made on the under-side. Cut through one half the thickness of the leather at a sufficient distance from the edge to catch the lay on both sides in stitching. Now adjust the buckle and lay once again, and then trim four loops about  $\frac{5}{8}$  in. wide and place one before the buckle, a second on the other side before reaching the first opening, another between the two openings, and, finally, the fourth beyond the lash.

The lay must be stitched in from the underside with double waxed thread, a cross stitch being made at the corners of each opening and the thread being brought straight over the opening to the opposite corner without cutting. Stitch over the loop at the slit end, but no farther, the remainder being stitched fine round the end from above. It is better to stitch the crupper lay from below because it will then be smoother and the stitches will not be so likely to rub the hair off as when they are on the surface, there being much friction at this part. Having placed the stick in the loops, finish with the hot iron, making a running loop for the billet.

The dock (Fig. 188) that is placed under the tail is made of soft close-grained leather, 1 ft. 3 in. in length, and tapered from the centre on each side to about  $\frac{7}{8}$  in. when doubled over at the points. Groove it carefully along the edges at a slight distance therefrom, and stitch it loosely with three-cord fine hemp, about six per inch, merely pulling the stitches home; then damp it well.

Having a pint of whole linseed near at hand, drive a nail through one end to close the opening, and then, placing the linseed on the apron, scoop

it in with the open end and ram the dock tight from end to end with a stick or iron rod till it is filled.

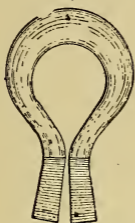


Fig. 188.

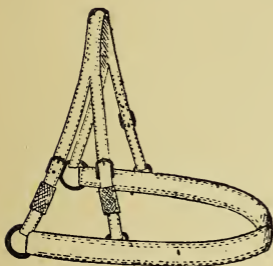


Fig. 189.



Fig. 191.

Fig. 188.—Crupper Dock.  
Fig. 189.—Breeching, etc.  
Fig. 190.—Back-band.  
Fig. 191.—Shaft Tugs.



Fig. 190.

Take one end in each hand and twist the piece to a round shape, endeavouring to bring the stitches on

the lower side. Knock the two ends with nails in them into a flat board, and keeping the centre on the board, raise both sides and draw them as close together as possible with a piece of soft leather tied around them. Then allow them to dry and trim the stitched part and sand it, rounding it with the other parts; polish well, thin the top sides of the points, and knock them flat with the hammer. Stitch one to each slit of the crupper body for about  $\frac{3}{4}$  in., finish the edges, and put about a dozen holes in the billet.

To make the breeching (Fig. 189), cut the leather 7 ft. 6 in. by  $1\frac{3}{4}$  in., and turn it in 4 in. at the better end, so that it will be 3 ft. 8 in. long when double. If the lower part is too long, cut it off, allowing about 2 in. for splicing, and shave both ends. Both edges must now be shaved on the inside of the top and bottom so as to slant outwards; damp the top from one bend to the other. Round it on the large groove of the grooving board, crease it along both edges, and prick it eight per inch. If the bend seems too weak for the rings these can be lined. Cut a strip of leather or an old rein, 1 in. wide, and shave it round along the edges and at the ends; it must be long enough to run from ring to ring.

Having prepared the rings and breeching dees (Fig. 178 and 179, p. 125), cut the bearers from good leather, 10 in. by  $\frac{3}{4}$  in.; turn them down so that the points will meet, and flatten the bends. Prepare one end of each for the buckle, and cut a groove along the lower side, where there is no joint, and open it. Place the buckles and dees in two bearers and the rings and buckle in the two remaining, joining them on the side under the loop. Stitch the ends together, making them meet exactly in the centre of the bearer.

After edging the end bends, black them, because this would be troublesome work later; then cut

four loops,  $3\frac{1}{2}$  in. by  $1\frac{3}{8}$  in., blind-stitch them, and finish them like the others. Make the pattern match, finish the back of the bearer, and close the groove well. A ring must now be put in each end of the breeching, which is then tacked in place for stitching. Place the lining lately cut in the centre to raise and strengthen it, and then stitch along both the sides with three-cord coarse hemp; reserve an opening about 6 in. from the ring for the bearers, but do not fix these in it until the body has been stitched and trimmed.

Some fancy style of stitching can be run along each end from the ring about 6 in. when the straight lines have been stitched along the sides, or have two extra straight lines instead of fancy work, bringing the lines to a point at 6 in. from the ring, or again make four rows all along the breeching.

The body being well trimmed and finished, put both bearers in on the same side, one at each end where the opening was left. Before this, however, put a small piece of leather inside to fill the hollow square in the breeching dees; stitch this firmly in place.

For a hip-strap to match the breeching, cut a strap 4 ft. long and a little more than double the width of the buckles on the bearers; slit it for 16 in. at each end, each slit being the width of the bearer buckles, and if it is altogether too wide, the waste should come off the centre. Then edge, black, and crease it neatly and put eight holes in each end.

The breeching straps to go round the shafts must be cut 3 ft. 3 in. by  $1\frac{1}{4}$  in., and when the light ends are turned down, are 2 ft. 6 in. long. Round the point, and shave that of the turn over; then prepare the bend for the buckle, and edge, black, and crease.

Cut four strong loops about  $\frac{7}{8}$  in. wide, and having neatly finished them, prick along about 3 in. from the buckle on the lower side. Tack on the

two loops, one near the buckle in the usual position, and the other close to it but in the reverse position to turn under the strap. Stitch them with strong thread, and, having finished them, bend the strap from the loop to the end of the underpiece and run a dozen stitches on each side at the point. Bend it so that when in position in the ring the parts will be even; if stitched without bending, the lower part will pucker. Finish the loops and put six holes in each strap.

The back-band (Fig. 190, p. 147) may now be cut out, its complete length being 8 ft. The centre piece passing through the saddle is 3 ft. 3 in. long, the strap or buckling end measuring 1 ft. 6 in., and the remainder being for girth. If it is for a van harness it must be in three thicknesses along the centre, but the strap end will be strong enough in two thicknesses; when the belly-band part is very light it may also be thickened a little. Place the belly-band buckle in the belly-band end, and if necessary line the chape; then round the point at the strap end. Crease all along and make two rows on each side of the centre, bringing them together in a point at the extremities. Strictly speaking, one row on each side of the belly band and strap will suffice, but four rows are better; in the last case, crossing the two middle centre lines at the end of the centre part will improve the appearance.

An opening must be left in the stitching about  $1\frac{1}{2}$  in. from the buckle, and two openings lower down, 2 in. apart, to receive three loops when the back-band has been completed. Stitch it about eight per inch, with four-cord thread.

For finishing, use a spokeshave, and rub the stitches underneath to level them well; round the edges well towards the stitches, making the edges neat in appearance. Scrape it with glasspaper, place the buckle on the hook, and black the edges

and stitches; rub vigorously with the rag in the right hand, holding each side of the back-band with the other. The hand should be moved briskly backwards and forwards so as to dry and polish the edges well. Now pass a ball of tallow along the edges and again rub well with the rag, after which the three loops may be placed on the belly band and stitched from below, the reverse side to the other stitches. Then punch eight or nine holes in the strap and three in the centre part at equal distances from each crossing of the middle row of stitches, or from the point of the inner rows if the centre only has four rows of stitching. Leave about 1 ft. 6 in. in the centre without holes.

The shaft tugs (Fig. 191, p. 147) are made by cutting a 1 ft.  $7\frac{3}{4}$  in. length of leather to the same width as the buckles and back-band—that is,  $1\frac{3}{4}$  in. Overlap this piece  $4\frac{1}{2}$  in., the overlap then being bent together and knocked flat in the centre. Through both leathers cut a hole for a buckle in the bend, and shave a little on the sides of the hole underneath where the tongue enters, so that the buckle will run close to the leather.

Shave both ends, the inner very thin and the outer or top one moderately, cutting a little off each corner. Crease two rows on each side as on the back-band, and, having pricked the rows seven per inch, place the brass or nickel loop loose on the strap and adjust the buckle therein. Draw the two holes in the centre, where the buckle is placed, exactly opposite each other, and stitch the top point of the overlap along the two inner lines for about 2 in. through the two leathers.

The shape being now obtained, the tug must be filled and thickened. This is done by cutting a piece of leather to fit the inside tight from one side of the buckle to the other, keeping the buckle in position while working. Cut a nick in the centre of each end of this piece so that the tongue and

sides may fit close to the buckle, and then cut another good piece of leather to go round inside tight and to overlap at the top for about  $1\frac{1}{2}$  in. Now shave each end and cut a groove on each side for about the length of the loop on the part intended for it, and overlap it on the side opposite the loop just below the buckle, with the outer point of the overlap on the top pointing towards the buckle and not downwards.

If the tug needs more thickening, place another piece under the inside lining to reach from the metal loop (placed below the leather loop) round the bottom and about halfway up the other side, leaving it with its thickness at the end near the metal loop; shave the other end thin.

The metal loop must fit tight between the end of the piece and the leather loop. It must now be tacked together from the inside, the joint at the overlap being made firm. The lining should be of sole leather; damp it well so that it will fit into its place and be easier to stitch. Begin stitching at the buckle with four-cord thread and work round to the metal loop; then begin at this part on the other side and stitch to the buckle. Continue to work in this way until four rows are stitched.

Trim the edges, and black and polish them, paying particular attention to the part about the buckle.

There is an opening from the metal loop to the buckle remaining unstitched; this, with a groove cut underneath on the lower side, is for the loop, which must be about 2 in. wide. Having inserted one side for about half the width of the tug, stitch it with six-cord double waxed thread from the buckle to the metal loop, being careful to bring the awl out with each stitch in the centre of the groove. Stitch the other side as far as the buckle and make two or three cross stitches on each side of the buckle.

If there is much unevenness on the part from the end of the loop to the buckle, a little filling may be put in the space. The loop must be longer than usual because the back-band is extra thick. Shape the loop with a thick bent loop-stick big enough to make plenty of room for a back-band. Black and finish the loop, make a pattern or check it if necessary, and then remove all unevenness, close the grooves, and trim neatly about the loop and buckle. Repeat the operation with the second tug, and then all will be ready.

The big loops for a shaft and the hame tugs, etc., must always be made of firm loop leather,

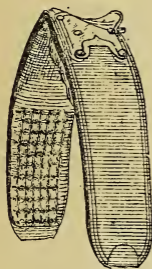


Fig. 192.—Four-wheeled  
Cab Saddle.

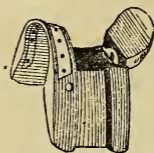


Fig. 193.—Cab Saddle Tree.

which will grow hard in finishing and retain its firmness and shape in spite of rain and weather.

For the traces, trace end chains will be needed ; van and cab traces are stitched to the hames, being shortened by having ten or twelve links of a chain at the other end. The traces may be 4 ft. 9 in. long by  $1\frac{3}{4}$  in., being 1 ft. 1 in. longer with a chain. They must be in three thicknesses, but with two thicknesses to go through the chain dee and hame ring (Fig. 171, p. 123).

In putting the upper and lower part together, place the light end of one against the heavy end of the other, thus levelling the trace and making it

of equal strength. Shave the points well where one ends and another begins—for example, the lining in the hame ring and chain dee. Having turned the leathers down to the right length, crease and prick them, seven or eight per inch. Tack down with only the chain on and stitch the four rows, but not so far in the hame end as to prevent the hame ring being placed in position when they are finished. When both are stitched, trim, black, and polish them; then rub down the stitches underneath, and having fixed them to the hame ring, stitch them to it, and finish that end like the other parts.



Fig. 194.



Fig. 195.

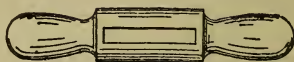


Fig. 196.

Fig. 194.—Hansom Cab Saddle. Figs. 195 and 196.—Rein Stops.

Make two hame straps  $\frac{7}{8}$  in. wide, the top strap 1 ft. 10 in. long, and the lower 1 ft. 4 in. Adjust the buckles at the strong ends and make two loops, reversing them as on the breeching straps; have seven or eight holes in each.

The driving reins are 1 in. wide, and the forepart near the horse's head is 6 ft. long on each side. Turn down the chapes at the strong ends for the buckles, and shave the point thin; then cut two billets, 1 ft. long, from a firm piece of leather. Shave one end and round the other, and, having cut

two loops, edge and finish them ; then rub all and crease them close to the edge with a hot creaser.

Adjust the buckles, prick the part of the billet to be stitched a little inside the outer crease, and stitch the billets in with the loop. When the loops are finished, make a hole in each billet far enough from the point to allow what is over to come through the loop, and cover the stitches on the front.

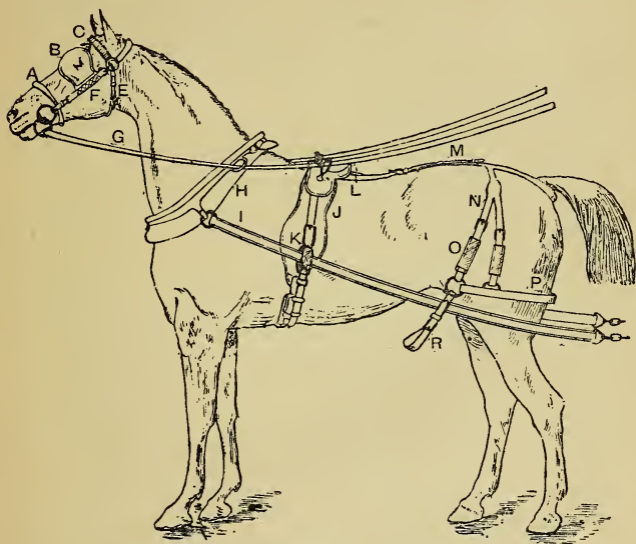


Fig. 197.—Hansen Cab Harness.

Make the brown hand parts 5 ft. 6 in. long, and narrow the light end of one part to pass through into a  $\frac{3}{4}$ -in. covered buckle ; then turn down the other point and narrow it for the buckle chape. Finally, prepare a narrow brown loop. Shave and taper the other end of the hand parts to a point, edge both sides below and under, and damp the edges with gum and water, or with water only.

Polish them well by rubbing, making them even everywhere ; brown paper is excellent for polishing either black or brown edges.

After creasing them very near the edge with a screw crease, place the buckle and loop on the end and mark a line a little inside the outer one, about  $2\frac{1}{2}$  in. or 3 in. long, on the end to be spliced on the fore-part. Prick it fine and stitch with a fine thread, pointing the stitches in the upper end to the same shape as the others. The hand parts can be obtained ready cut with buckles, and then all that has to be done is to shave the ends and stitch them to the fore-parts.

Four-wheel cab harness can be made in the same way as van harness, except the saddle (Fig. 192), which is made exactly like a gig saddle, but is heavier and has brass or nickel screw studs in each corner of the skirts ; Fig. 193 shows the top or tree.

Hansom cab harness is not much different, though the saddle (Fig. 194) is lighter, and some have rollers inside the saddle so that the back-band may run smoothly backwards and forwards through the tree ; these trees are made to order. In Fig. 197, A indicates the noseband, B winker, C forehead band, E throatlash, F cheek, G rein, H collar, I trace, J saddle, K shaft tug, L cantle of saddle, M crupper, N tug strap, O bearer, P breeching, and R shaft strap.

The hansom reins must be about 20 ft. long on each side, each brown hand part being about 7 ft. long. They are generally showy and ornamental. Winkers and saddle, hip straps, martingale, and breastplate have ornaments, the reins have ivory rings and stops (Figs. 195 and 196), and there is a face-piece ornament on the bridle.

Both four-wheeler and hansom harness (Fig. 197) are larger and heavier than gig harness, except at the saddle.

# INDEX.

- Awls, 21, 22
- Back Stitching, 52
- Backband Hook, Plough, 107
- , Van Harness, 150
- Backs, Hide, 37, 39, 40
- Ball Terret, 124
- Band, Forehead, 68
- Bands, Mill, 40
- , Nose, 63
- Basils, 40
- Beeswax, 30
- Bells and Brush, Bridle, 63
- Belly Band, Cart, 99
- Belt, Waist, 49
- Bent Awl, 21
- Bevellers, 21
- Billet, 93
- Bits, 111-116
- Black Wax, 31, 33, 45
- Black-ball, 44
- Board, Cutting, 42
- Body-belt Webs, 45
- Box Creased Loop, 57
- Loop, 57
- Strap, 49
- Spurs, 116
- Brace End Punch, 15
- Brass Face-pieces, 63
- Gear Buckles, Scotch, 63
- Hame Plates, 63
- Nails, 35
- Ornaments, 63
- Polishing Paste, 47
- Squares, 63
- Swing, 63
- Breaking Bit, 116
- Breeching, Cart Harness, 96
- , Van Harness, 149
- Bridle, 70
- Hides, 38
- Bridoon Bits, 112, 114, 115
- Bronzing for Leather, 48
- Brown Gear Hides, 40
- Harness Hides, 40
- Shoulders, 39
- Stain, 46
- Wax, 45
- Brush and Bells for Bridle, 63
- Buckle Tongue Punch, 14
- Buckles, 63, 118-126
- Buff Hides, White, 41
- Buff Middling, White Bleached, 41
- Bull Hides, Enamelled, 41
- Burgess's Buckles, 124
- Burnisher, 44
- Butts, Black Strap, 33
- Buxton Bit, 115
- Cab, Hansom, Harness for, 156
- Harness, 156
- Saddle, 156
- Tree, 156
- Calf-skins, 40
- Cart Belly Band, 99
- Collars, 75-85
- Harness, 62-74
- Saddles, 86-100
- —, Panel of, 86
- —, Tree for, 86
- Cement, Leather, 47
- Chain Front, 141
- Chains, 125
- , Hip-strap, 103
- Chapes, 66
- Chased Buckles, 123
- Chatham Buckles, 123
- Checkers, 20
- Cheek Curb Bit, Globe, 114
- Chin Strap, 71
- Clamp or Clams, 24
- Clip, Hame, 123
- Clout Nails, 34
- Coach Hides, 41
- Collar, Cart, 75-85
- , Lining, 73
- , Pipe, 77
- , Rod, Iron, 27
- Side-piece, 83
- , Van, 123
- Coloured Flocks, 36
- Couplings for Plough Gear, 110
- Compasses, 21
- , Race, 21
- Composition, Harness, 46
- Corner-piece, Nose-band, 69
- Cow-backs, Japanned, 38
- Cow-hides, Enamelled, 41
- Creased Loop, Box, 57
- Creases, 19
- Crew Punch, 14
- Crupper, Cart Harness, 93
- Dock, 143

- Crupper, Van Harness, 145  
 Curb Bit, 115  
 ———, Globe Cheek, 114  
 Cut Tacks, 34  
 Cutter, Washer, 13  
 Cutting Board, 42  
 ——— Gauge, 10, 11  
 ——— Pliers, 27  
 Cutting up Hides, 42  
  
 Dees, Breeching, 143  
 Diaper Webs, 45  
 Dock, 146  
 Double-rein Hides, 39  
 Dress Spurs, 116  
 Drummed Flocks, 36  
 Dye, 35  
 Dyeing, Iron Liquor for, 45  
  
 Ear-piece, 69  
 Edge Trimmers, 12  
 Enamelled Hides, 41  
 Exercising Bit, 116  
  
 Face-pieces, Brass, 63  
 Farm Harness, Oil for, 47  
 Felt, 36  
 Files, 29  
 Flap Hides, Japanned, 38  
 Flocks, 36  
 Flour Paste, 45  
 Fly-terrets, 124  
 Foot-rule, 21  
 Fore Gear and Leader Harness, 101-106  
 Forehead Band, 63  
 ———, Van Harness, 141  
 Forewale, 76  
 Fork, Straining, 29  
 Four-wheel Cab Harness, 156  
  
 Gauge, Cutting, 10, 11  
 ———, Plough, 11  
 Gear Buckles, Scotch, 63  
 ——— Hides, Brown, 40  
 ———, Plough, 107-110  
 ———, Shaft, 62  
 Gig Curb Bit, 115  
 ——— Harness, 127  
 ——— Snaffle, 113  
 Gilding Leather, 43  
 Girth, Cart Saddle, 91  
 ——— Chape Punch, 15  
 ———, Van Harness, 137  
 ——— Webs, 44  
 Globe Cheek Curb Bit, 114  
  
 Hackney Bits, 112, 113  
 Half-moon Scalloping Irons, 16  
 Hame Clip, 125  
 ——— Knobs, Brass, 63  
 ——— Plates, Brass, 63  
 ——— Straps, 89  
 ——— Tug Loops, 153  
  
 Hames, 124-125  
 Hammer, 17  
 Hand Knife, 10  
 ——— Punch, 15  
 Hand-iron, 23  
 Hanson Cab Harness, 156  
 ——— Saddle, 156  
 Hard Wax, 31  
 Harness, Cab, 127-156  
 ———, Cart, 62-74  
 ——— Composition, 46  
 ———, Fore Gear and Leader, 101-106  
 ———, Gig, 127  
 ——— Jet, 47  
 ——— Oil, 47  
 ———, Plough, 107-110  
 ———, Van, 127-156  
 ——— Waterproof Paste, 47  
 Head Knife, 10  
 ——— Strap, 73  
 Head-collar Rein Backs, 39  
 Hearts, Brass, 63  
 Hemp, 30, 33  
 Hides, 37-42  
 ———, Cutting up, 42  
 Hind Tugs, 97  
 Hip-strap Chains, 103  
 Hog-skins, 40  
 Hook, Plough Back-band, 107  
 ———, Wire, 61  
 Horse Hides, Japanned, 38  
 Horsehair, Curled, 36  
 Housing, Cart Saddle, 92  
  
 Iron Collar Rod, 27  
 ———, Hand, 23  
 ——— Liquor for Dyeing, 45  
 ———, Palm, 23  
 ———, Pricking, 18  
 ———, Scalloping, 16  
 ——— Seat, 27  
  
 Jambles Plates, 63  
 Japanned Hides, 38  
 ——— Nails, 34  
 ——— Welting Seals, 38  
 ——— Winker Hides, 38  
 Jet, Harness, 47  
  
 Knives, 10  
  
 Lace Needles, 53  
 Ladies' Horse Bits, 112  
 ——— Spurs, 116  
 ——— Stirrups, 117  
 Lash, Throat, 73  
 Lead Piece for Punching, 16  
 Leader Harness, Fore Gear and, 101-106  
 Leather, 37-42  
 ———, Bronzing, 48  
 ——— Cement, 47  
 ———, Fancy, 41

Leather Preserver, 47  
 —, Patent, Reviver for, 46  
 —, Testing Quality of, 41  
 Lignum-vitæ Round Mallet, 17  
 Linen Threads, 30  
 Lining Cart Saddle Panel, 87  
 — Collar, 78  
 — Winkers, 127  
 Liverpool Bits, 114  
 Loin Straps, 93  
 Loop, Box, 57  
 —, Creasing, 59  
 — Leather, Dyeing, 35  
 —, Pipe, 57  
 —, Running, 49, 57  
 Looping, 57-61  
 Loop-sticks, 28  
  
 Machine, Slitting, 11  
 Mallets, 17  
 Materials, 30-48  
 Melbourne Buckles, 124  
 Middling, White Bleached Buff,  
 41  
 Mill Bands, 40  
  
 Nail-claw, 27  
 Nails, 34, 35  
 Needles, 22  
 —, Threading, 51  
 Nipple, Hand Punch, 16  
 Nose-band, 63  
 —, Van Harness, 140  
  
 Octagons, Brass, 63  
 Officers' Spurs, 116  
 Oil, Harness, 47  
 Oval Punch, 13, 14  
 Ovals, Brass, 63  
 Ox Hides, Enamelled, 41  
  
 Palm-iron, 23  
 Panel, Cart Saddle, 86  
 —, Van Saddle, 134  
 Paring Knife, 10  
 Paste, 45, 127  
 —, Brass Polishing, 47  
 —, Harness, 47  
 Patent Leather Reviver, 46  
 Pelham Bits, 112  
 — Snaffles, 113  
 Pincers, 27  
 Pipe Collar, 77  
 — Loop, 57  
 Plate Powder, 47  
 Pliers, 27  
 Plough Back-band Hook, 107  
 — Gear Couplings, 110  
 — Harness, 107-110  
 Plough-gauge, 11  
 Pocket-book or Purse Hides, 40  
 Polishing Paste, Brass, 47  
 Powder, Plate, 47

Preserver, Leather, 47  
 Prickers, Wheel, 19  
 Pricking-iron, 18  
 Punches, 13-16  
 Punching, Lead Piece for, 16  
 Purse or Pocket-book Hides, 40  
  
 Race Compasses, 21  
 — Girth Webs, 44  
 Rasps, 29  
 Rein, 73  
 — Backs, Head-collar, 39  
 — Hides and Backs, 38  
 — Stops, 156  
 Reins, Van Harness, 154  
 Reviver, Patent Leather, 46  
 Riding Bits, 112  
 — Saddles, Stain for, 46  
 Rivets, 126  
 Roller Buckles, 126  
 — Girth Webs, 44  
 Rosette Punches, 16  
 Round Awl, 22  
 — File, 29  
 — Knife, 10  
 — Punch, 13, 14  
 Round-headed Nails, 34  
 Rubber, 28  
 Running Loop, 50, 57  
 Russet Brown Stain, 46  
  
 Saddle, Cab, 156  
 —, Cart, 86-100  
 — Girths, 91  
 —, Hansom Cab, 156  
 — Stain, 46  
 — Straps, 91  
 —, Van, 130  
 Safety Slipper Stirrup, 117  
 Scalloping Irons, 16  
 Scotch Brass Gear Buckles, 63  
 Screw Crease, 19  
 — Race, 19  
 — Spurs, 116  
 Seals, Japanned Welting, 38  
 Seal-skins, 41  
 Seat Awl, 22  
 — Iron, 27  
 Sewing Awl, 21  
 Shaft Gear, 62  
 — Tug Buckles, 124  
 — Tugs, Clamp for Sewing, 24  
 —, Van, 151  
 Sheep-skins, 40  
 Sheep's Wool, 36  
 Shoulders, Hide, 38-40  
 Show or Stallion Bit, 116  
 Silk Threads, 30  
 Single Crease, 19  
 Skins, Calf, 40  
 —, Hog, 40  
 —, Seal, 41  
 —, Sheep, 40  
 —, White, 53

- Skirt Hides and Backs, 40  
 Slipper Stirrups, 117  
 Slitting Machine, 11  
 Snaffles, 113, 116  
 Spokeshave, 11  
 Spur Shoulders, Black, 38  
 Spurs, 116  
 Square File, 29  
 Squares, Brass, 63  
 Stain, 35  
 Stains, Various, 46  
 Stallion or Show Bit, 116  
 Stars, Brass, 63  
 Steel Seat-iron, 27  
 Stirrup Hides, 40  
 Stirrups, 117  
 Stitching Awls, 21  
 —, Back, 52  
 —, Simple Exercises in, 49-56  
 — with White Lace, 52  
 Straight Scalloping Irons, 16  
 Straining Fork, 29  
 — Webs, 45  
 Strap, Box, 49  
 — Butts, Black, 38  
 — for Cart Saddle, 91  
 —, Chin, 71  
 —, Hame, 99  
 —, Head, 73  
 —, Loin, 98  
 —, Winker, 72  
 Swing, Brass, 63  
 Swivelled Bridoon Bit, 115  
 Swivels, 124  
  
 Tacks, Cut, 34  
 Tallow, 31  
 Team Harness, Oil for, 47  
 Terrets, 124  
 Threads, 30, 33, 75  
 Throat Lash, 73  
 Tools, 10-29  
 Trace Backs, 37  
 —, Van Harness, 153  
 Tree, Cab Saddle, 156  
  
 Tree, Cart Saddle, 86  
 —, Van Saddle, 132  
 Trimmers, Edge, 12  
 Trousers Spurs, 116  
 Tugs, Hind, 97  
  
 Van Collar, 123  
 — Harness, 127-155  
 — Saddle, 130  
 Vandyke Scalloping Irons, 16  
 Vice, 27  
  
 Waist-belt, 49-56  
 Washer Cutter, 13  
 Waterproof Harness Paste, 47  
 Wax, Black, 31, 33, 45  
 —, Brown, 45  
 —, Hard, 31  
 —, White, 30  
 Waxed Threads, 30  
 Webs, 44, 45  
 Welting Seals, Japanned, 33  
 West End Buckles, 122-124  
 Weymouth Bits, 112  
 Wheel Prickers, 19  
 White Bleached Buff Middling,  
     41  
 — Buff Hides, 41  
 — Flocks, 36  
 — Hemp Thread, 33  
 — Lace, Stitching with, 52  
 — Skin, 53  
 — Wax, 30  
 Wilson Snaffle, 113  
 Winker Hides, 38  
 — —, Japanned, 38  
 — Straps, 72  
 — —, Van Harness, 142  
 Winkers, 64, 127  
 Wire Hook, 61  
 — Nails, 34  
 Wrench, 27  
  
 Yellow Hemp Thread, 33  
 — Stain, 46

# ENGINEER'S HANDY-BOOK.

CONTAINING

## FACTS, FORMULÆ, TABLES AND QUESTIONS

ON POWER, ITS GENERATION, TRANSMISSION AND MEASUREMENT;  
HEAT, FUEL AND STEAM; THE STEAM-BOILER AND ACCESSORIES;  
STEAM-ENGINES AND THEIR PARTS; THE STEAM-ENGINE IN-  
DICATOR; GAS AND GASOLINE ENGINES; MATERIALS,  
THEIR PROPERTIES AND STRENGTH:

TOGETHER WITH A

DISCUSSION OF THE FUNDAMENTAL EXPERIMENTS IN

## ELECTRICITY,

AND AN EXPLANATION OF

DYNAMOS, MOTORS, BATTERIES, SWITCHBOARDS, TELE-  
PHONES, BELLS, ANNUNCIATORS, ALARMS, Etc.,

AND ALSO

RULES FOR CALCULATING SIZES OF WIRES.

BY

STEPHEN ROPER, ENGINEER,

AUTHOR OF

"Roper's Catechism of High-Pressure or Non-Condensing Steam-Engines,"  
"Roper's Hand-Book of the Locomotive," "Roper's Hand-Book of  
Land and Marine Engines," "Roper's Hand-Book of Modern  
Steam-Fire Engines," "Young Engineer's Own Book,"  
"Use and Abuse of the Steam-Boiler," "Ques-  
tions and Answers for Engineers," etc.

FIFTEENTH EDITION.

REVISED AND GREATLY ENLARGED BY

EDWIN R. KELLER, M. E.,

AND

CLAYTON W. PIKE, B. S.,

*Ex-President of the Electrical Section of the Franklin Institute.*



PHILADELPHIA:

DAVID MCKAY,

1022 MARKET STREET.

# ROPER'S

## Practical Hand-Books

### For Engineers and Firemen.

---

NEW REVISED AND ENLARGED EDITION.

#### HANDY-BOOK FOR STEAM ENGINEERS AND ELECTRICIANS.

PRICE, \$3.50.

	PRICE.
Roper's Catechism for Steam Engineers and Electric- ians, . . . . .	\$2.00
Roper's Questions and Answers for Steam Engineers and Electricians, . . . . .	2.00
Roper's Hand-Book of Land and Marine Engines, .	3.50
Roper's Care and Management of the Steam Boiler, .	2.00
Roper's Use and Abuse of the Steam Boiler, . . . .	2.00
Roper's Young Engineers' Own Book, . . . . .	2.50
Roper's Hand-Book of the Locomotive, . . . . .	2.50
Roper's Instructions and Suggestions for Engineers and Firemen, . . . . .	2.00
Roper's Hand-Book of Modern Steam Fire Engines, .	3.50

---

DAVID MCKAY, Publisher,  
1022 Market Street, Philadelphia, Pa.

## TECHNICAL INSTRUCTION.

Important New Series of Practical Volumes. Edited by PAUL N. HASLUCK. With numerous Illustrations in the Text. Each book contains about 160 pages, crown 8vo. Cloth, \$1.00 each, postpaid.

### **Practical Draughtsmen's Work.** With 226 Illustrations.

*Contents.*—Drawing Boards. Paper and Mounting. Draughtsmen's Instruments. Drawing Straight Lines. Drawing Circular Lines. Elliptical Curves. Projection. Back Lining Drawings. Scale Drawings and Maps. Colouring Drawings. Making a Drawing. Index.

### **Practical Gasfitting.** With 120 Illustrations.

*Contents.*—How Coal Gas is Made. Coal Gas from the Retort to the Gas Holder. Gas Supply from Gas Holder to Meter. Laying the Gas Pipe in the House. Gas Meters. Gas Burners. Incandescent Lights. Gas Fittings in Workshops and Theatres. Gas Fittings for Festival Illuminations. Gas Fires and Cooking Stoves. Index.

### **Practical Staircase Joinery.** With 215 Illustrations.

*Contents.*—Introduction: Explanation of Terms. Simple Form of Staircase—Housed String Stair: Measuring, Planning, and Setting Out. Two-flight Staircase. Staircase with Winders at Bottom. Staircase with Winders at Top and Bottom. Staircase with Half-space of Winders. Staircase over an Oblique Plan. Staircase with Open or Cut Strings. Cut String Staircase with Brackets. Open String Staircase with Bull nose Step. Geometrical Staircases. Winding Staircases. Ships' Staircases. Index.

### **Practical Metal Plate Work.** With 247 Illustrations.

*Contents.*—Materials used in Metal Plate Work. Geometrical Construction of Plane Figures. Geometrical Construction and Development of Solid Figures. Tools and Appliances used in Metal Plate Work. Soldering and Brazing. Tinning. Re-tinning and Galvanising. Examples of Practical Metal Plate Work. Examples of Practical Pattern Drawing. Index.

### **Practical Graining and Marbling.** With 79 Illustrations.

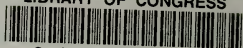
*Contents.*—Graining: Introduction, Tools, and Mechanical Aids. Graining Grounds and Graining Colors. Oak Graining in Oil. Oak Graining in Spirit and Water Colours. Pollard Oak and Knotted Oak Graining. Maple Graining Mahogany and Pitch-pine Graining. Walnut Graining. Fancy Wood Graining. Furniture Graining Imitating Woods by Staining. Imitating Inlaid Woods. Marbling: Introduction, Tools, and Materials. Imitating Varieties of Marble. Index.

*Ready Shortly: Practical Plumbing Work.*

*Other New Volumes in Preparation.*

DAVID MCKAY, Publisher, 1022 Market Street, Philadelphia.

LIBRARY OF CONGRESS



0 016 055 697 3